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ElectronicsWeek®

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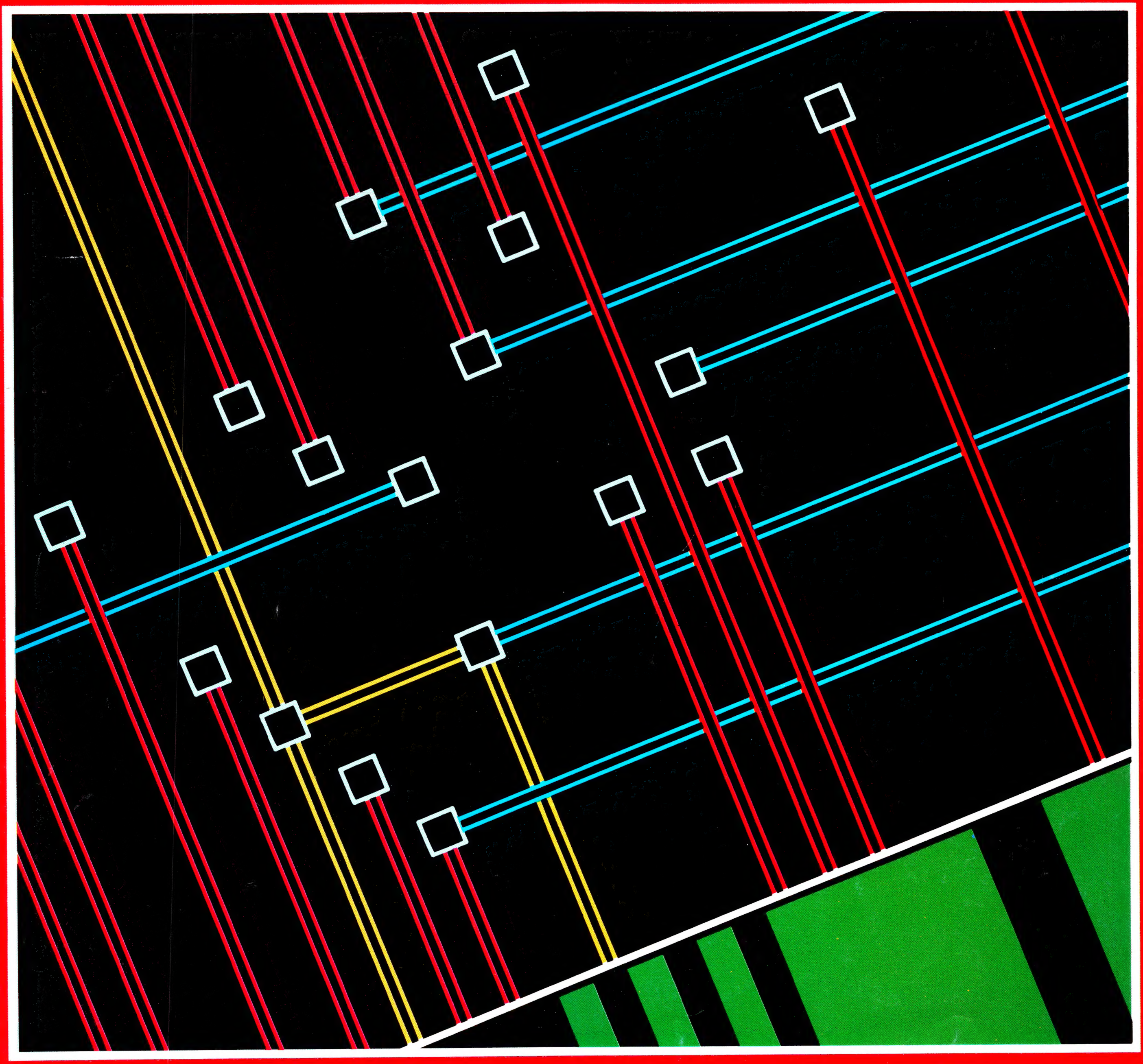

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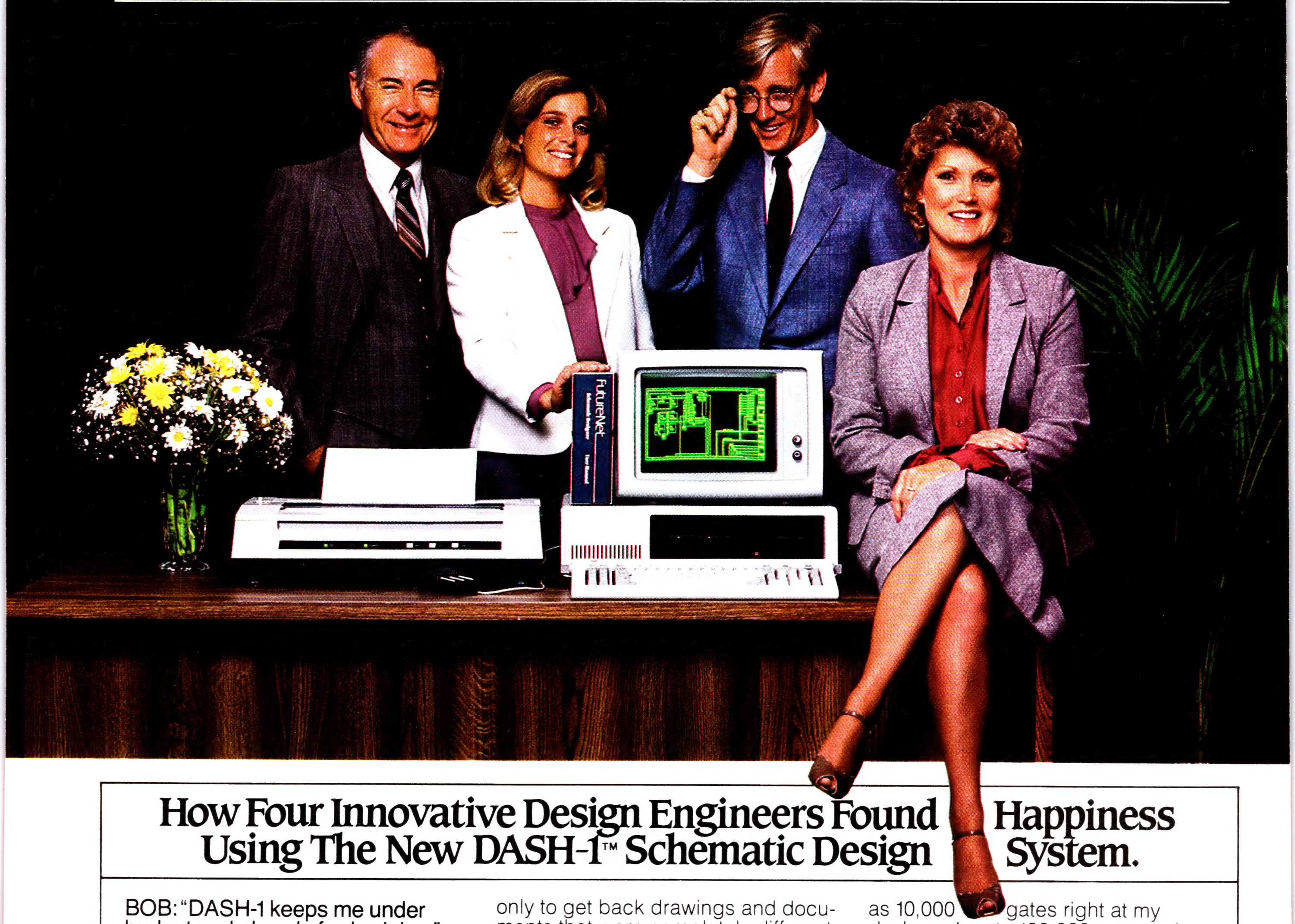

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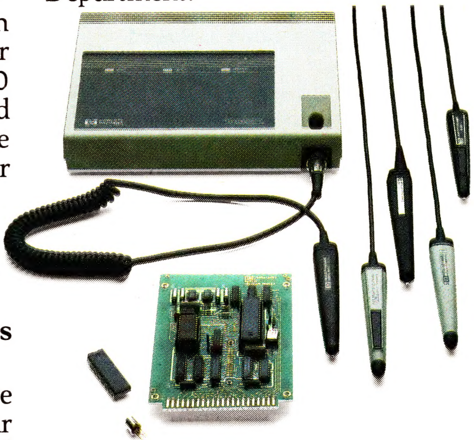

HP: The right choices for bar code solutions.

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Next ElectronicsWeek

Software tool makers look forward to booming market

The need for more and better tools to support and automate the software life cycle has attracted both hardware manufacturers and independent vendors to a market whose growth should surpass that of the exploding software applications arena, according to market observers. For a peek into the software industry's future, see contributing editor Stephen Evanczuk's article in the next issue of *ElectronicsWeek.*

Digital ICs brighten computer displays

The technology that promises to push TV out of the entertainment era and into the information age is the same technology that is responsible for video games, home computers, videotex, and teletext: the video display processor. Mark Kisner and Jean Ladd of Texas Instruments have examined the most recent advances in display processors and their applications in home information systems. Read their findings in next week's issue.

Looking ahead in ElectronicsWeek

New techniques for liquid-crystal displays

As designers seek to take advantage of liquid-crystal displays' inherently low power consumption and high readability, even in sunlight, new design techniques are being applied. Birendra Bahadur of Data Images Inc. has researched the latest technology for an upcoming *ElectronicsWeek* article.

Cutting OEM gate-array turnaround and costs

Until recently, gate-array designs involved expensive mainframe use and months of time. Now, a time-sharing service called Unicad-1 promises to cut time nearly in half and slash OEM costs as well. Read about Unicad-1 in an upcoming *ElectronicsWeek.*

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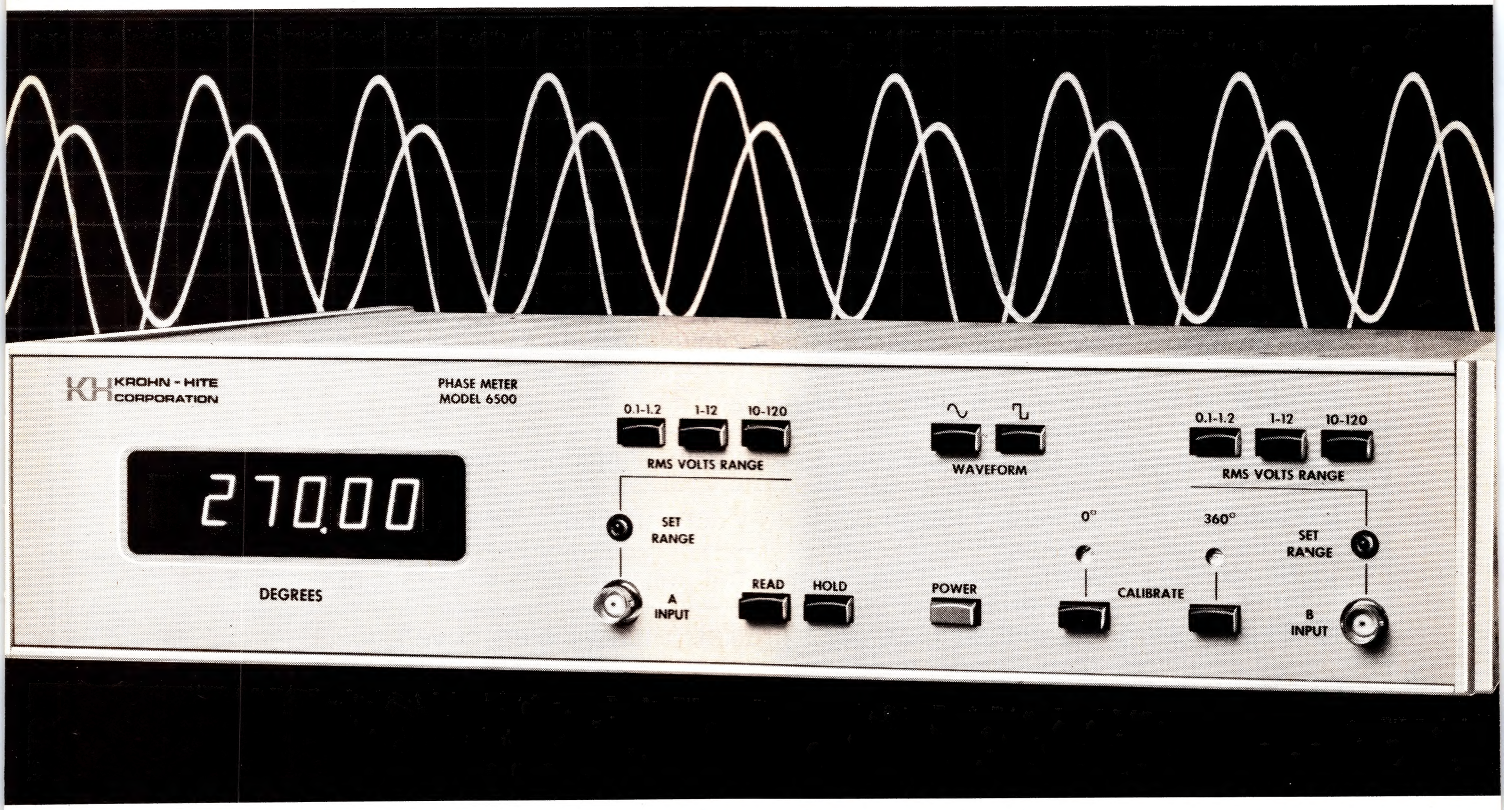

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ElectronicsWeek

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Special Technology Reports

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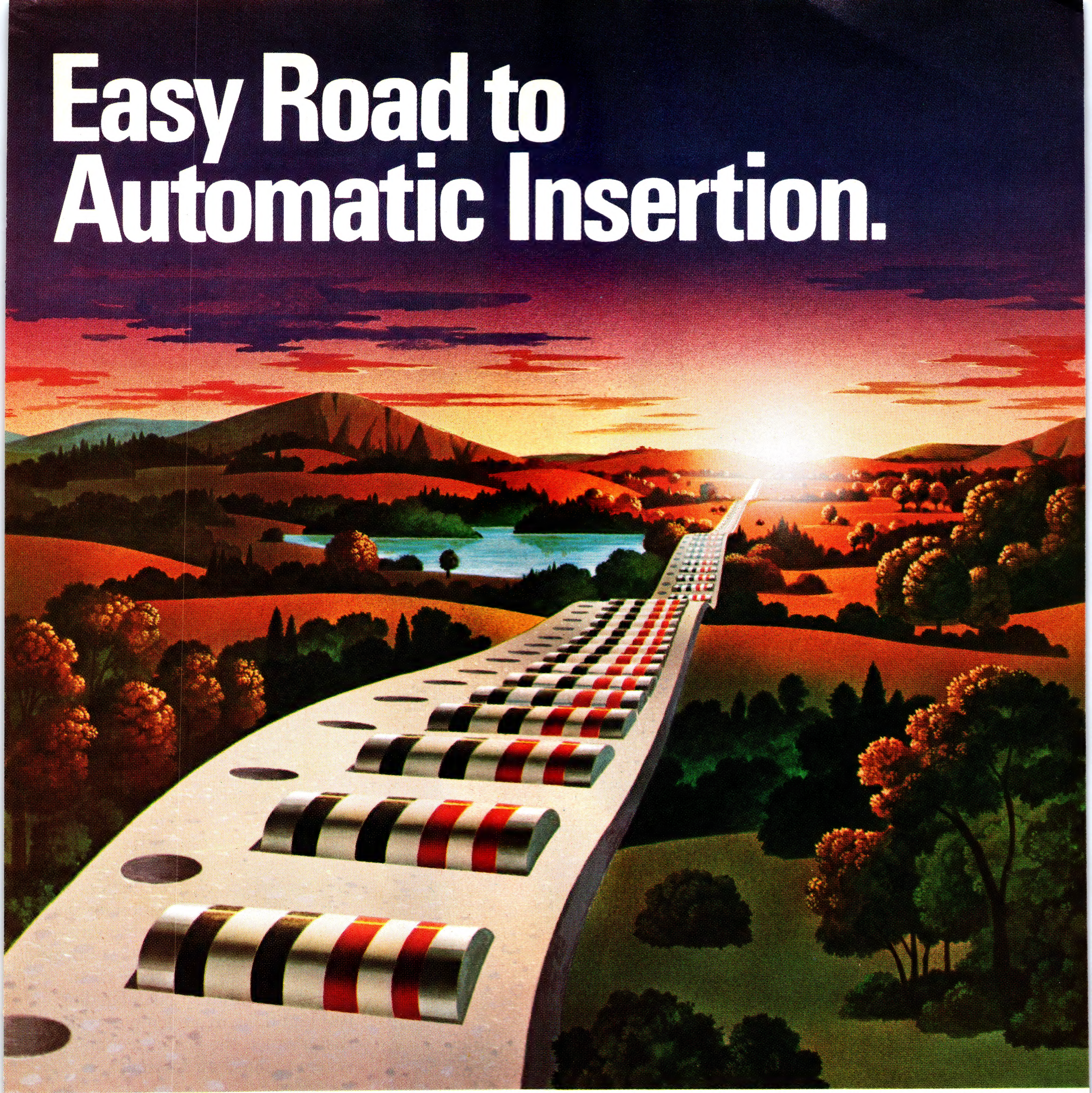
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Result: Energy bills could be slashed by a simpler, more cost-effective system.

◄ **Moving energy costs down** by moving air around—that's how TI's new LinCMOS A/D peripherals could work in a large building. These ICs could take multiple readings of each room's temperature for a microprocessor that quickly determines where warmer or cooler air is needed.

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control system with TI's new microprocessor-controlled A/D ICs.

DATA-ACQUISITION EVOLUTION

	1979-83	1981-85	1983-1990s
Technology:			
Process:	Metal-gate CMOS	Metal-gate CMOS	Si-gate LinCMOS
Circuit:	Resistor ladder	Switched capacitor	Switched capacitor
Converter:			
Part types:	ADC0808, 0809N	TL520, 521, 522N	TLC532A, 533A
Size:	8,000 mil²	1,700 mil²	500 mil²
Components:	256 resistors 511 switches	9 capacitors 26 switches	9 capacitors 26 switches
Features:			
Bar size:	29,000 mil²	21,000 mil²	15,000 mil²
Speed:	10k samples/sec.	14k samples/sec.	67k samples/sec.
Error:	±0.75 LSB	±0.75 LSB	±0.5 LSB
Inputs:	8 analog	8 analog	11 analog*

*Includes six multipurpose inputs.

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Dramatic speeds are available—as fast as 71,000 samples per second. With power requirements as low as 6.0 mW.

This allows noise canceling and precise control of blower motors or heating elements. While virtually eliminating bulky power supplies.

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Both the TLC532A family and the TLC540 family offer excellent temperature-range stability—total output error is within ±0.5 least significant bit (LSB) over a wide temperature range—from −40° to 85°C.

Military versions, also available, are stable within ±0.5 LSB over a −55° to 125°C temperature range.

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Each LinCMOS A/D peripheral family allows a processor to monitor up to 11 analog signals. Six signals can be digital, if preferred, allowing keyboard or switch-position sensing.

These devices feature a built-in sample-and-hold circuit (software-controlled on the TLC540) that holds a "snapshot" of the input signals to reduce the effects of noise and random spikes.

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For more information on TI's A/D converters, op amps, and the LinCMOS process that creates them, call your authorized TI distributor or nearest TI sales office. Or write Texas Instruments Incorporated, Dept. SLA043EC, P.O. Box 809066, Dallas, Texas 75380-9066.

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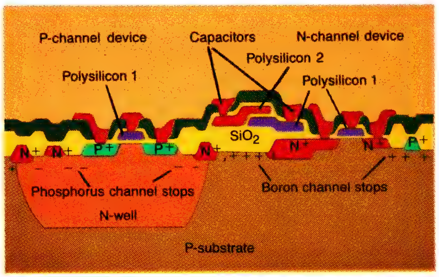
And the final result: A built-in speed advantage that greatly enhances AC performance and makes possible the 20X speed improvement of the TLC532A over its pin-compatible metal-gate TL532 predecessor.



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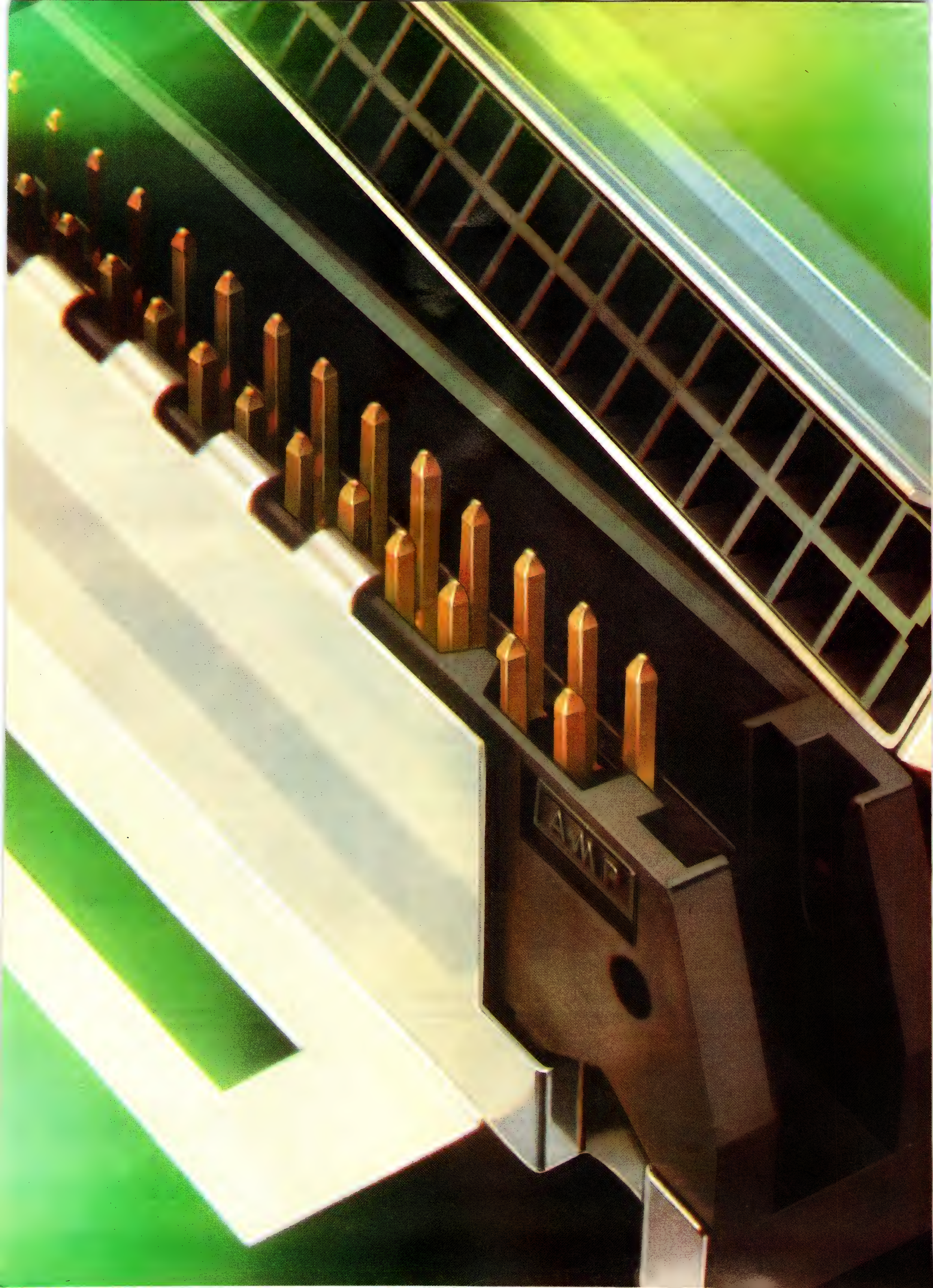
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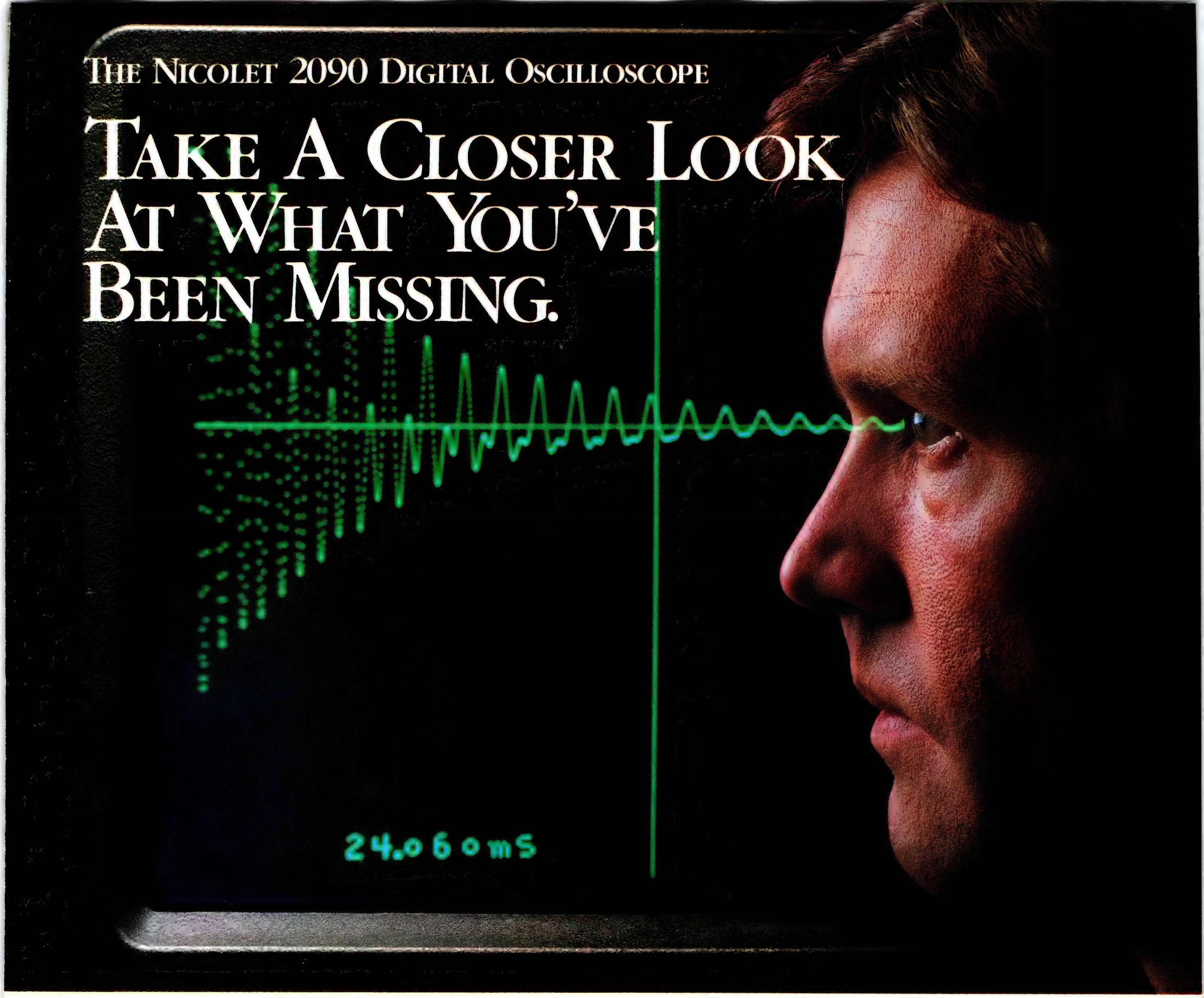

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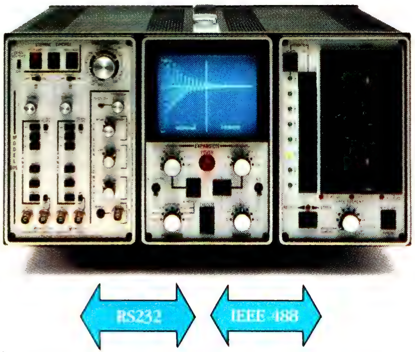

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MILITARY'S VHSIC CHIPS QUICKSTEP INTO FINAL PHASE

Contracts should be awarded this month for second-phase submicrometer chips as first-phase chips are readied to report for duty in hardware

☐ *By Wesley R. Iversen*

Washington, D.C.

September should be a landmark month for the Department of Defense's Very High-Speed Integrated Circuits program. Contracts for manufacturing the second and final round of chips—ones having millions of transistors with 0.5-μm line widths and operating speeds of 100 MHz or better—should be awarded by the end of the month. Meanwhile, the Phase 1 chips—based on 1.25-μm technology—have started to move toward field service and could begin showing up in military systems next year.

In short, VHSIC is doing better than many observers thought it would when the DOD initated it five years ago. All six contracting teams for Phase 1 have successfully fabricated chips (see "Honeywell claims record for IC density"). The DOD has funded some 37 projects to the tune of about $150 million to get the technology into the field, says E.D. (Sonny) Maynard Jr., director of VHSIC and electron devices in the office of the Under Secretary of Defense for Research and Engineering. "Dates for insertion opportunities [of Phase 1 chips] range from 1985 to 1991," he notes.

Power-packed. Current indications are that Phase 2 chips will provide another hundredfold improvement in processing power per cubic inch over their predecessors, Maynard says. Pentagon officials originally had expected the VHSIC program to yield about a hundredfold improvement in performance—compared to 1980 levels—over its entire six-year life (now extended to nine years), he points out. Phase 1 chips are already achieving that goal.

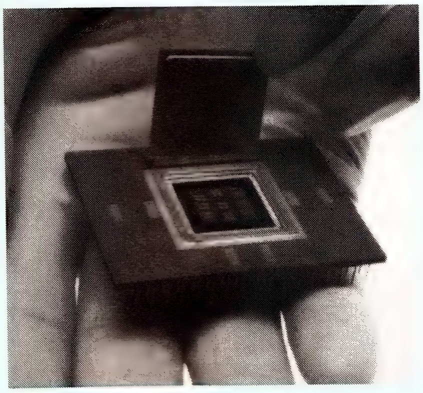
Phase 2 will have a little less money but also fewer contractors. The anticipated budget is about $150 million, which compares to about $165 million for Phase 1. Although six contracting teams participated in the earlier chip-making phase, Maynard says current plans call for only three Phase 2 contractors. One major reason for the smaller crew of contractors is the likely requirement for

Honeywell claims record for IC density

Among the latest chips to be successfully fabricated under Phase 1 of the Very High-Speed Integrated Circuits program are two from Honeywell Inc., Minneapolis, that the firm's VHSIC program director, Dallas D. Burns, bills as "the most complex bipolar chips ever built."

The Honeywell sequencer and arithmetic chips—part of a three-chip set to be used on an electro-optic signal-processing brassboard to go to the Air Force around year-end—integrate 136,000 and 121,000 devices, respectively. Both chips were fabricated using 10:1 direct-step-on-wafer technology and all-dry etching in an oxide-isolated integrated-Schottky-logic process that features 1.25-μm minimum geometries and three levels of metal.

Notably, fully functional arithmetic chips were produced on the first silicon pass in June, says Burns, while the sequencer chip required only metal mask modifications after the first run. The third chip in the set, known as the parallel pipeline processor, will mix ISL and current-mode-logic on the same chip and will integrate 142,000 devices. It is scheduled to complete its second pass in silicon during September. As with the sequencer, only minor metal errors were found after the first silicon pass; Honeywell says these can be fixed by changes on only the last two of the 15 or so masks used to fabricate the chip.



All three chips were designed using a library of 43 macrocells, some of which contain as many as 2,000 gates. The majority of these cells contain between 200 and 600 gates, however. Tape automated bonding is used to mount each chip in a ceramic 180-pin array package (left). —W.I.

electron-beam lithography; Phase 1 contractors were generally able to use commercially available optical lithography equipment. Another reason is a longer contract period: four years instead of three.

Maynard declines to provide names of Phase 2 bidders. But the list probably includes the six leading Phase 1 contractors—Honeywell, Hughes Aircraft, IBM, Texas Instruments, TRW, and Westinghouse Electric. Other possibilities are AT&T Technologies, Harris's Semiconductor Sector, and RCA.

Yields. Meanwhile, Maynard notes that reaction to the coming availability of Phase 1 chips has been enthusiastic among the potential customers. As a result, the Pentagon is negotiating what are called yield-enhancement contracts with Phase 1 contractors, aimed at driving the technology rapidly down the learning curve. These contracts, some of which have already been signed, will call for the VHSIC chip makers to ramp up to 60 to 100 wafer starts per week during a 32-month contract period.

"The yield-enhancement program is being instigated not because we're not satisfied with the yields we've been seeing," says Maynard. "We're either at or ahead of where we expected to be at this point."

Rather, "we've gotten very enthusiastic responses from the customers, who would like to get these chips sooner than could be expected on a normal learning curve." Maynard says Phase 1 chip yields are currently running in the 1%-to-2% range and that the yield-enhancement programs could raise that range to 10% to 20%.

Designs. Additional DOD-funded efforts are underway to develop an integrated design automation system (IDAS). "This is a major venture that we're engaged in, in terms of technology insertion, for making it possible for the other 200 or so major electronic systems houses that work for the DOD to have an input node to the VHSIC technology," Maynard explains.

The first step is the development of a universal language for describing hardware specifications—the VHSIC hardware description language (VHDL). A draft version has already been produced under a contract awarded about a year ago to Intermetrics Inc., Cambridge, Mass., with TI and IBM as subcontractors. Maynard hopes VHSIC and other semiconductor vendors will adopt VDHL as a standard; later it will be transformed into an intermediate form that can interact with software tools for VHSIC chip design.

The DOD is working with various standards organizations within the design automation community to come up with an appropriate interface for linking software tools under IDAS, Maynard says. The front runner for that job right now appears to be the common Ada interface specification (CAIS) developed under the Ada program. The first of two contracts for a package of IDAS tools, including an executive package based on artificial-intelligence techniques, should be awarded this month.

REGIONS

Congress studies Valley's success

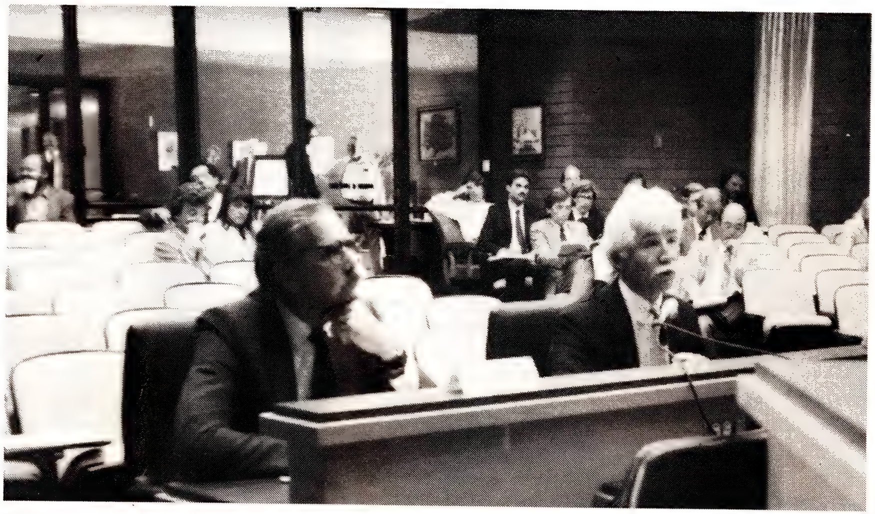
Sunnyvale, Calif.—With its phenomenal economic growth and flamboyant individual success stories, Silicon Valley must look like fabled El Dorado to economically depressed areas of the U.S. To see if this profile could be emulated elsewhere, the Joint Economic Committee of the U.S. Congress last week held hearings in this bustling 23-square-mile city, which claims to be the home of more electronics companies than any other city in the world.

Although the committee has no legislative responsibilities, the industry nevertheless trotted out its top brass. Leading off in presentations before the committee were Intel vice chairman Robert N. Noyce, National Semiconductor chief executive officer Charles Sporck, Advanced Micro Devices chief executive officer W.J. (Jerry) Sanders III, C. Lester Hogan of Fairchild Camera & Instrument Corp., and the valley's public relations laureate, Regis P. McKenna.

Noyce, Sporck, and Sanders were all at Fairchild in the 1960s, when Silicon Valley consisted of that firm, Hewlett-Packard, Varian Associates, and thousands of acres of apricot trees. Hogan, who had built Motorola Inc. into a semiconductor giant, succeeded Noyce at Fairchild and has since been active in organizing industry support for university research. McKenna has represented dozens of electronics startups (including Apple Computer Inc.), and has spawned a satellite industry of his own, the high-tech public relations firm.

What the Silicon Valley executives described, with remarkable unanimity, was a geographic area in which industry was supported by a strong university system (principally Stanford and the University of California at Berkeley), where venture capitalists flourish, and where individuals are free to hop from job to job fulfilling personal goals.

"You will find that most of us in



Sitting pretty. National Semiconductor's Charles Sporck (left) and Advanced Micro Devices's Jerry Sanders spoke about Silicon Valley's success before a congressional committee.

Silicon Valley are strong supporters of the free enterprise system, free reciprocal trade, unfettered mobility of people between jobs, and a tax system that recognizes the unusual risk taken by venture capitalists," Hogan said. They were also supporters of a benevolent personnel policy, in which organized labor had no role to play, of tax incentives to support risk and tax breaks to support research, and of an end to restrictions on the hiring of foreign engineers.

Noyce cited "four M's" necessary for the success of Silicon Valley companies: money for investment, supported by tax laws that reward it; manpower produced by a strong educational system and access to foreign talent; markets without unnecessary export controls; and motivation for entrepreneurs, in the form of adequate financial and personal rewards.

Duplication difficult. The speakers doubted whether their entrepreneurial Elysium could be duplicated elsewhere because of the need for the kind of powerful infrastructure that has been built in the valley over the past 20 years. (Hogan, however, cited the Route 128 area near Boston, Research Triangle Park in North Carolina, and Austin, Texas, as burgeoning high-tech areas.) But what all agreed on was that government could best promote the growth of high-tech industries—in Silicon Valley as well as elsewhere—by supporting basic research and by removing all limitations placed on financial incentive.

When asked what had been gained from the event, AMD's Sanders notes, "We've been in an educational process with Washington for five years. . . . We're gradually building a consensus about tax credits, capital gains, and priorities for the nation."

Added Rep. Dan Lungren (R-Calif.), chairman of the committee, "Silicon Valley has shown that it can compete successfully with the rest of the world, by maximizing risk-taking and innovation. To some extent, Japan, our biggest competitor, has followed the blueprint developed here."

The unfettered development of the valley, he added, had implications for the congressional debate over whether the U.S. needs an explicit national industrial policy. From the example of Silicon Valley, he said, it doesn't. –**Clifford Barney**

SENSORS

Sapphire substrates improve HgCdTe infrared detectors

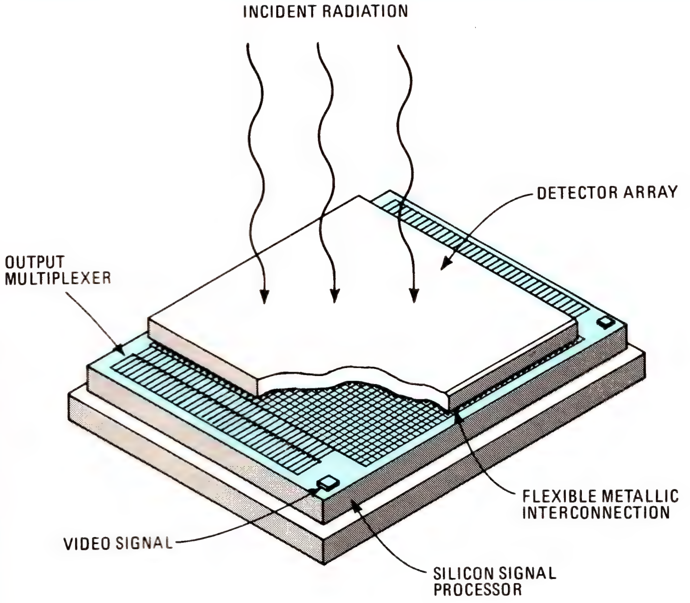
Thousand Oaks, Calif.—Mercury cadmium telluride, the proven workhorse material for infrared detectors, is on its way to greater reliability. A team working at Rockwell International Corp.'s Science Center has found an alternative substrate—sapphire—that appears to do away with many of the drawbacks of earlier HgCdTe devices. Nonetheless, the Rockwell researchers are looking at other materials for applications where wavelengths in the upper half of the infrared spectrum are needed.

It was cadmium telluride—the substrate of the earlier devices—that had been causing most of the problems: it breaks easily, and its electrical properties vary widely across the wafer so that devices from different

Making the most out of an IR image

For maximum sensing performance, Rockwell International Corp.'s Science Center in Thousand Oaks, Calif., utilizes a two-layer focal-plane array that contains all the elements for turning an infrared image into digital data for processing. The array consists of two planar chips: on top is the detector array to convert IR radiation to electrical current, and on the bottom is a silicon multiplexer for reading out individual detector signals. Between the two is a flexible metallic interconnection.

The mercury cadmium telluride arrays are fabricated with spectral responses that are tailored to specific parts of the IR spectrum, which spans from 1 micrometer to 12 μm. Short-wavelength devices, 1 to 4 μm, are used to view the earth from aircraft; mid-wavelength devices, 3 to 5 μm, are for night viewing, missile seeking and space surveillance sensing. Long-wavelength arrays will be turning up in future advanced systems. –**Larry Waller**



regions of the same wafer perform differently. By turning to sapphire substrates, the Rockwell team has fabricated detectors that improve the crucial characteristic of electrical uniformity by a factor of 10, says project director J. T. Longo, the associate director for electronics and electro-optics.

This evaluation comes from measuring the level of picture-element output of the new detectors packaged in a focal plane array (see "Making the most out of an IR image," p. 19) and comparing the results with an array of devices made with the conventional CdTe substrate. Only 2% to 3% of the new detectors are performing below peak, compared to as many as 25% for the earlier version. The contrast is underscored by the fact that the test represents only the first new devices produced, while the 25% figure for the earlier version is a best-ever mark, explains Longo.

Innovation. The new Rockwell fabrication technique, dubbed PACE (producible alternative to cadmium telluride for epitaxy) has also scored high with the Department of Defense, the biggest customer for IR sensors. (It uses them extensively for all-weather, day-night target seeking and surveillance systems.) The Defense Advanced Research Projects Agency, in fact, gave PACE the top research award for work done in 1983 for technical innovation, calling it a "dramatic breakthrough." Moreover, it "shows great promise of enhancing the performance, producibility and cost features of HgCdTe," according to the Darpa award.

To build the devices, Rockwell uses a liquid-phase epitaxy process, long since perfected for silicon devices. As a result, fabrication can be controlled more precisely than is possible with conventional CdTe substrates. Also, growing the devices on 2-in. sapphire wafers, instead of on the irregularly shaped 0.5-to-1.5-in. CdTe pieces, gains a good cost edge. "PACE costs $5 to $15 per square centimeter, against $100 [for conventional detectors]," notes Longo.

Uncertain. Investigators are not certain why PACE works so well, but they believe "it is something in the process itself," Longo says. For one thing, sapphire contains none of the jagged low-angle grain boundaries of CdTe, along which dislocations cluster. In addition, microscopy shows PACE remarkably free of voids and defects.

Whatever the reasons for its success, Rockwell has not spared horsepower in bringing PACE out of the laboratory. A production line is already up and running at the Defense Systems Group, in Anaheim, Calif., turning out arrays in a 32-by-32-cell configuration.

These arrays are going into a number of military programs, which Rockwell cannot discuss. But the detectors also play a role in a National Aeronautics and Space Administration application: an airborne imaging spectrometer. Already flight-tested, this instrument will be used for mineral exploration on a future space shuttle mission. Within six months, a 64-by-64-cell array will be ready.

The serious limitation of the PACE detector is that it does not work well above the middle portion of the infrared spectrum (wavelengths between 3 and 5 μm. This is caused by an absorption band in sapphire that closes off the longer wavelengths. **–Larry Waller**

CHIP CARRIERS

Waterproof, long-lived epoxy chip carrier for pc boards finally sees the light at the end of development tunnel

Wokingham, England—After a slow start, a printed-circuit-board chip carrier that uses neither ceramic nor premolded plastic may at last be heading for commercial success. The Epic chip carrier, developed by British pc-board and hybrid maker Tectonics Ltd., with help from British Telecom, neatly solves one problem with surface-mounted components—making a reliable bond between the chip carrier and the board on which it is mounted [*Electronics,* October 20, 1981, p. 74].

Because both the board and the

How to make a million

The Epic chip package is made on nearly standard printed-circuit-board production lines. The major difference is the use of a precision diamond saw, which usually slices semiconductor wafers but here cuts up the pc board into individual chip carriers. These are batch-manufactured—a 40-by-30-cm pc-board laminate contains up to 1,000 chip-carrier bases and allows even a small production line to handle a capacity of several million devices a week.

The most complex part, the base of the chip carrier, is defined photolithographically by a step-and-repeat camera. The 0.5-mm copper-clad laminate is drilled, and the through holes are plated using a semiadditive process.

The sidewalls and lid are made from unclad epoxy-glass laminate similar to the base. A film of adhesive is attached to one side of the laminate, and then the composite is routed to form arrays of sidewalls in precise dimensional registration with the arrays on the base part. The base and sidewall arrays are bonded in a conventional multilayer pc-board press, then the assembly is bonded to a carrier tape and cut along the lines of the plated through holes to form individual chip carriers. The packages come in tubes ready for use by automation machinery. **–Kevin Smith**

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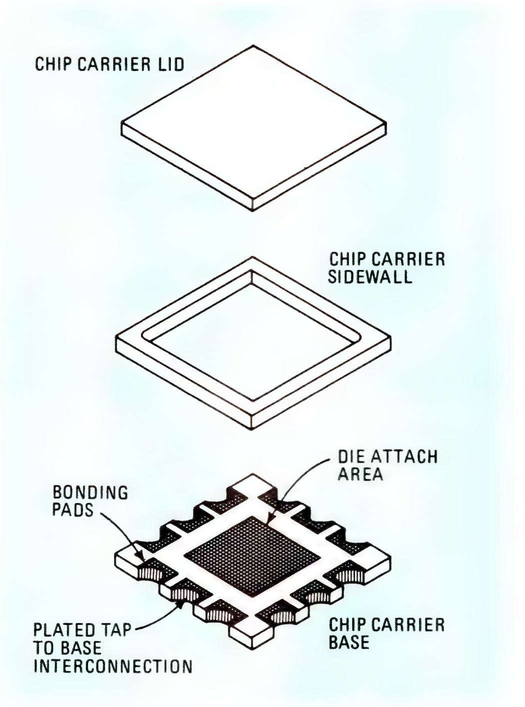
Tough. Because both the board and the Epic chip carrier are of epoxy-glass, thermal stresses that would crack solder joints are absent. The chip is encased in epoxy.



chip carrier are made of epoxy-glass, there are no thermal stresses that would otherwise crack solder joints. The chip itself is directly mounted on the chip carrier and encased in a protective blob of epoxy.

The General Instrument Corp., in Hicksville, N.Y., tried something very similar with its Minipack, introduced in 1976 [*Electronics,* March 17, 1977, p. 86]. But the British package is both moistureproof and good for 20 years of operation, which is equal to the design life of switching gear for telecommunications exchanges.

Cheapness and the need for reliable solder bonds were the inspiration for the Epic package, but in evaluating the product, the Advanced Hardware Techniques group at British Telecom's Martlesham Research Centre has found other advantages. The Epic chip carrier surpasses its ceramic rivals on electrical performance because the solid conductors of its pads and the lower dielectric constant of the laminate yield a lower parasitic resistance, capacitance, and inductance than ceramic chip carriers do. Also, the plastic coating stops alpha particles.

In accelerated life-test techniques, the Epic package produced outstanding results when evaluated alongside three other package types, according to Nihal Sinnadurai, who heads up the Martlesham group. The 100-year cumulative failure rate for Epic was found to be 3%; that for ceramic chip carriers, 30%; for small-outline integrated-circuit packages, 98%; and for dual in-line packages, 97%.

The advanced techniques group has also improved Epic's thermal performance over earlier versions. Epoxy-glass is more of a heat barrier than a heat sink, says Sinnadurai, and this has limited chip dissipations to 500 mW. But by positioning extra plated through holes in the die bonding area, the thermal conductivity can be improved by a factor of 20. So when a package is provided with a heat sink, it can comfortably handle 10 W. Under these conditions, the die's junction temperature would be 100°C and that of the heat sink, 30°C. Moreover, says Sinnadurai, the extra package cost is negligible.

For all of Epic's attractions, Tectonics has had its problems bringing it to the market. Ambitious expansion plans brought the company to its knees in 1983, but managing director Anthony Cook and technical director William Gurnett salvaged the pc-board operation and the Epic technology. Subsequently, they have focused most of their efforts on promoting Epic in the U.S. market through S.A. Communications Inc., San Diego, which is currently prototyping Tectonics' line of standard and custom pc-board chip carriers. Several potential suppliers are negotiating a technology license with British Telecom, which holds the master patents on the technology [*Electronics,* Oct. 20, 1981, p. 86].

Initially, the idea was to offer a standard range of packages from 8 to 256 pins with 50- and 25-mil pitches. But, says Gurnett, the company has been inundated with requests for custom packages that can be tooled up for as little as $2,600.

Now the company must show that it can deliver in volume and can operate its nearly standard pc-board production lines at their potential capacity of 8 million of the new chip packages a week (see "How to make a million," p. 20). **–Kevin Smith**

FOREIGN TRADE

Tandon charges Korean disk drives are pirated, asks ban on imports

Washington, D.C.—Tandon Corp. has charged that five people—two of them former employees—stole its designs for a new half-height floppy disk and sold them to a South Korean conglomerate. The Chatsworth, Calif., disk-drive maker has petitioned the International Trade Commission for a ban on imports of the copied drives and has sued for $150 million in damages.

After a late-August examination of charges of industrial espionage and sabotage brought by Tandon, the ITC voted unanimously to launch an investigation. The commission has about a year to do its sleuthing and decide on a course of action.

Tandon made the charge against the Lucky-Goldstar Group, a Seoul-based conglomerate, and the Format Corp., a Westlake Village, Calif., company created by former Tandon employees. Two of them, Tandon claims, were former engineers who conspired to leave the firm and steal its proprietary technology for the TM 65, a new direct-drive, half-height 3½-in. floppy disk.

Coming clean. In its petition, Tandon explains that one of its former employees, Philip Tomasi, decided to come clean and advise Tandon of the situation "after much moral reflection" and the firm's promise not to institute a civil lawsuit against him. Tomasi's statement, which constitutes the evidence for Tandon's

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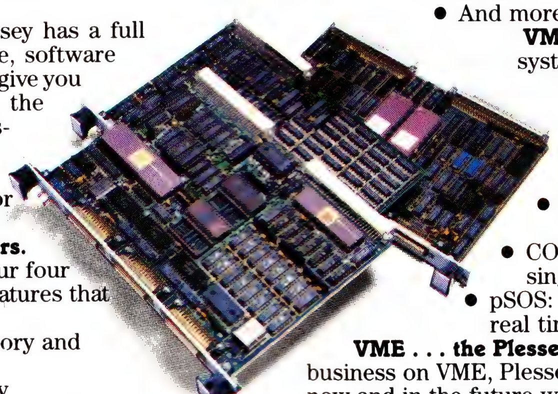

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claims, details a scheme whereby the ex-employees established Format, allegedly to build and sell a prototype of the 3½-in. drive that Tomasi had been developing at Tandon.

Part of that deal involved massive photocopying of Tandon documents and drawings. To make potential manufacturers believe that the documents were Format's, "We spent hours in front of a Xerox machine placing Format's logo on the Xeroxed documents where the Tandon name used to appear," Tomasi says in his statement attached to the petition. Moreover, his partners "used Tandon scopes and exercisers [sic] for tests, and assembled heads for Format drives at Tandon's facilities."

Good faith. Apparently, Lucky-Goldstar, rated by *Fortune* as the 50th largest industrial group outside the U.S., believed the Format product was authentic and agreed to pay $1 million for the design, with $500,000 as down payment. It then set up Gold Star Tele-Electric Co. to manufacture the drive, which Format planned to buy from a Lucky-Goldstar trading company based in Los Angeles.

The trading company reports that it stopped importing the disk drives two months ago because Format could not pay for them. *ElectronicsWeek* was unable to contact Format, which has no listed telephone number in Westlake Village.

Tandon contends that if Tomasi had stayed with Tandon and finished his work, the TM 65 direct-drive floppy disk system would have been in commercial production by the summer of 1983. His departure, coupled with prolonged sabotage, delayed product introduction by nearly a year, contends Tandon. As a result, the firm alleges, it has lost business in excess of $50 million while Gold Star Tele-Electric and Format can expect sales approaching $35 million in 1985.

At the same time it submitted the petition to the ITC in early August, Tandon filed a civil suit in Federal District Court in Los Angeles, seeking $150 million in punitive damages. From the ITC, Tandon wants relief in the form of an order barring entry of the South Korean-made drives to the U.S. and a permanent cease-and-desist order that would close down Format. –**Karen Berney**

CLOSED-CIRCUIT TV

IBM takes to the sky to extend interactive educational network

New York—International Business Machines Corp. doesn't believe in big classrooms to show its customers how to use its hardware and software. In fact, IBM has done so much teaching that last year its Informations Systems Group extended its closed-circuit-television education delivery system with a satellite-based network that was demonstrated to outsiders late last month.

The Interactive Satellite Education Network (ISEN) uses a compressed digital video technique that converts analog signals into digital form and transmits them from IBM broadcast studios in New York and Chicago to a satellite in a geosynchronous orbit 22,300 miles above the earth. These audio, video, and data signals are then beamed back and displayed in classrooms at satellite-receiving centers in New York, Chicago, Dallas, Houston, and Minneapolis.

IBM says a third broadcasting studio will be operational in Los Angeles by December, and there will be an additional six receiving centers in Los Angeles, San Francisco, St. Louis, Boston, Hartford, Conn., and in Washington, D.C.

The problem, as IBM saw it, was developing a cheaper delivery system that could link more remote customers with a single instructor, while retaining meaningful interaction between them. "The key feature of the system was the ability of the student to interact just as if he was in a [standard] classroom," explains W. Lee Noel, IBM's director of technical education.

Students can communicate with instructors by using a student response unit containing a voice-activated microphone, a call button, and a series of keys that are used to answer the instructor's multiple-choice questions.

Instructors are able to determine the location of a questioner, give tests, and score results by using information that is displayed on a touch-sensi-tive

In touch. An instructor in the studio of IBM's ISEN facility can work with customer-students across the U.S. by using the keyboard and the touch-sensitive screen at the control panel.

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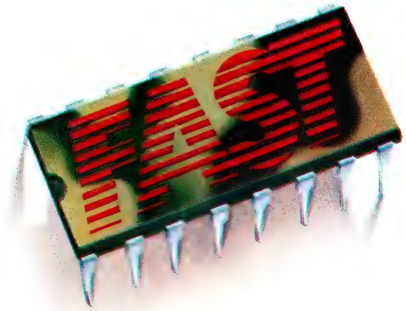

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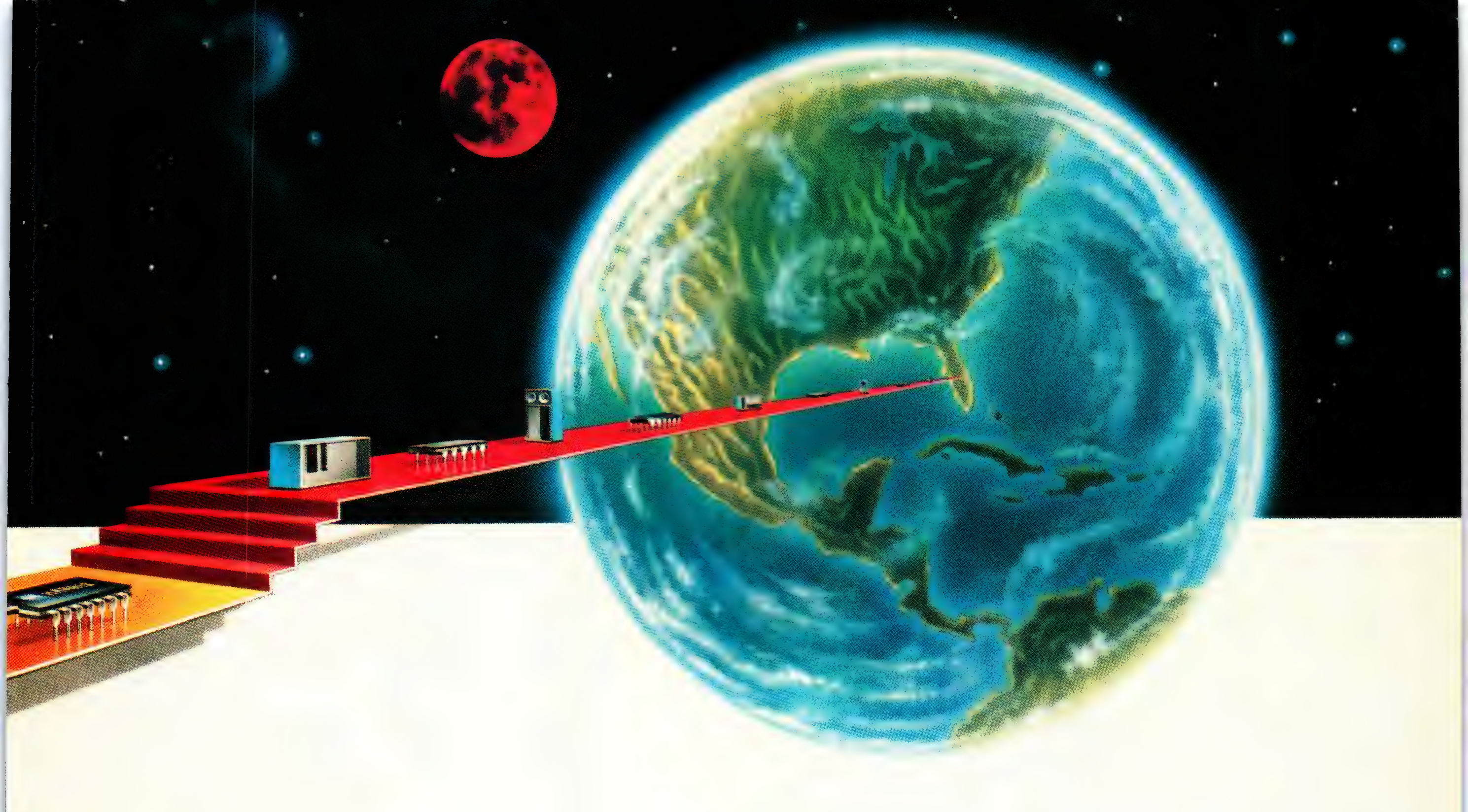

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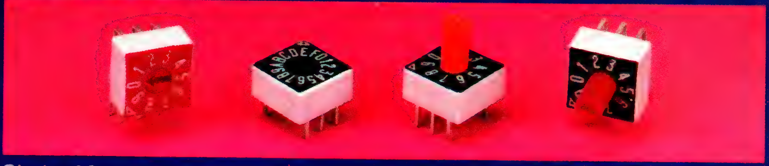

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screen in the ISEN studio.

Currently, 23 courses are being offered in data-processing management, communications, office computer systems, and operating systems. Courses typically last from three to four days with eight to 12 students per class. Noel estimates that 9,000 to 9,500 customers will use ISEN in 1984. **–George Leopold**

TRANSPORTATION

Electronic system drives autobus

Fürth, West Germany—When the bus driver takes his hands off the steering wheel and lets his vehicle run on its own, he is not trying to impress his passengers with daredevil affectation. What he is doing is letting an electronic system guide the vehicle, at least along a 1.4-km stretch of a bus route in this north Bavarian city.

The electronics system was developed by the New Technologies Division of the 144-year-old engine and commercial vehicle maker Maschinenfabrik Augsburg-Nürnberg AG. Central to its hands-off bus guidance is an electrified cable in the road surface. The induced electromagnetic field is picked up by antennas on the vehicle's undercarriage and processed to produce control pulses.

These pulses act on the vehicle's hydraulic system, which in turn operates on the steering rods, keeping the bus following the cable. It is appropriately named Spurbus, German for track bus.

The tests in Fürth, to last until the end of next year, are to determine system performance and driver reaction under actual conditions, as well as acceptance by the city's traffic authorities and the public. But Gunther Dreher, Spurbus project leader in charge of electronics system development, cautions against considering the current hands-off tests as a first step toward a driverless bus. "For psychological reasons, passengers and pedestrians will not approve of such means of transportation on a busy city street," he says.

Rather, what the Spurbus developers and supporters have in mind as practical goals are better use of available road space, greater economy, and more passenger comfort.

Given a fairly straight cable route and a relatively good road surface, the Spurbus deviates from the cable by no more than ±1 cm; it therefore gives passengers a much smoother ride than a driver can. To be sure, along curves or with strong side winds the deviations are greater, but they are still less than with manual steering.

In road layout and space allocation, German traffic authorities generally assign 3.5 m (about 11.5 ft) of lateral road space to a bus, which includes a safety margin on either side of the vehicle.

A vehicle equipped with the Spurbus's electronic guidance scheme, need be given only a 2.8-m (roughly 9-ft) track for safe navigation. That makes it possible for buses to operate along very narrow streets where they were not allowed to run before. Furthermore, because the buses are using less space, bridges and tunnels can be made narrower, saving considerable money.

What's more, an electronic system can guide a bus accurately along the edge of a platform at a bus stop without damage to the vehicle. If the platform is high enough, passengers can conveniently get off and on the bus without stepping up and down, a boon to the infirm.

Safety first. In developing the system, Dreher says, "safety was uppermost on our minds." Therefore, all components and subsystems are duplicated—and some cases even triplicated. This redundancy starts with the roadside equipment, where two generators feed an alternating current to the cable. The latter, a conventional 10-mm power cable, is placed in a slit 3 to 5 cm deep in the road surface and then is covered with tar.

The current, delivered at between 5 and 10 kHz, sets up an electromagnetic field concentrically around the cable. This induces voltages in the vehicle's two antennas—one in the front and the other in the rear of the undercarriage—with the voltage amplitude depending on the antennas' position relative to the cable.

In an electronics unit, behind the driver's seat, the antenna outputs are processed into a desired set-value signal. This signal acts upon the vehicle's hydraulic system, which moves the front axle's steering rods in such a way that the bus stays on its track as defined by the cable. The hydraulic system is redundant, too, having two identical, independently operating channels.

Look, Ma, no hands! The Spurbus, guided by a cable, can precisely navigate along the edge of a platform bus stop. Passengers can easily step straight on board and enjoy an exceptionally smooth ride.

Redundancy figures most in the electronics unit, which is designed as a three-channel system. Antenna signals are selected according to two-out-of-three principles: in one channel, three signals are compared with each other, and if one deviates from the others it is disregarded. Each of the two "good" signals is fed to the other channels for processing into outputs for the steering controls.

The channel in which signal comparison takes place has an Intel 8085-based monitoring and switching processor. It monitors the operation of each of the other two channels and switches operation from one to the other. The twin control channels are made to operate alternately for about 60 s, a measure to periodically ascertain that the channels are functioning properly. In the case of a malfunction in one control channel, the processor switches operation to the other control channel and, with an alarm, alerts the driver to the fact that he has only one channel to rely on. **–John Gosch**

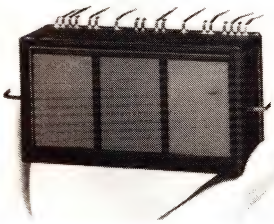
TELEVISION

Jumbo outdoor video display glows with 151,200 color cells

Tokyo, Japan—Visitors to next year's Expo '85 science and technology exposition at Tsukuba, approximately 60 km north of here, will be treated to a widescreen outdoor video display that is almost 160 ft. diagonally. Developed by Sony Corp., the display's brightness measures over 1,500 footlamberts—more than 10 times that of home TVs—for viewing in daylight. Optimum viewing distance is about 200 meters, but the display should be visible from 1 km away.

For Satoshi Shimada, general manager of the Product Planning Center, this display provided a second chance to pioneer in large matrix array panels. Back in 1968, he developed what he claimed was the world's first full-scale matrix array display for a TV set. Its 8-ft diagonal size was large for its time. The incandescent bulbs used as light-emitting elements were not elegant, but their use made it possible to develop the project without taking the time to invent a new type of display device.

This time around, though, Shimada did develop a new display device. It is in effect an oversize vacuum fluorescent tube, but totally unlike those used in calculators or test equipment. Shimada's cell can display color trios—individual side-by-side rectangles of red, green, and blue.



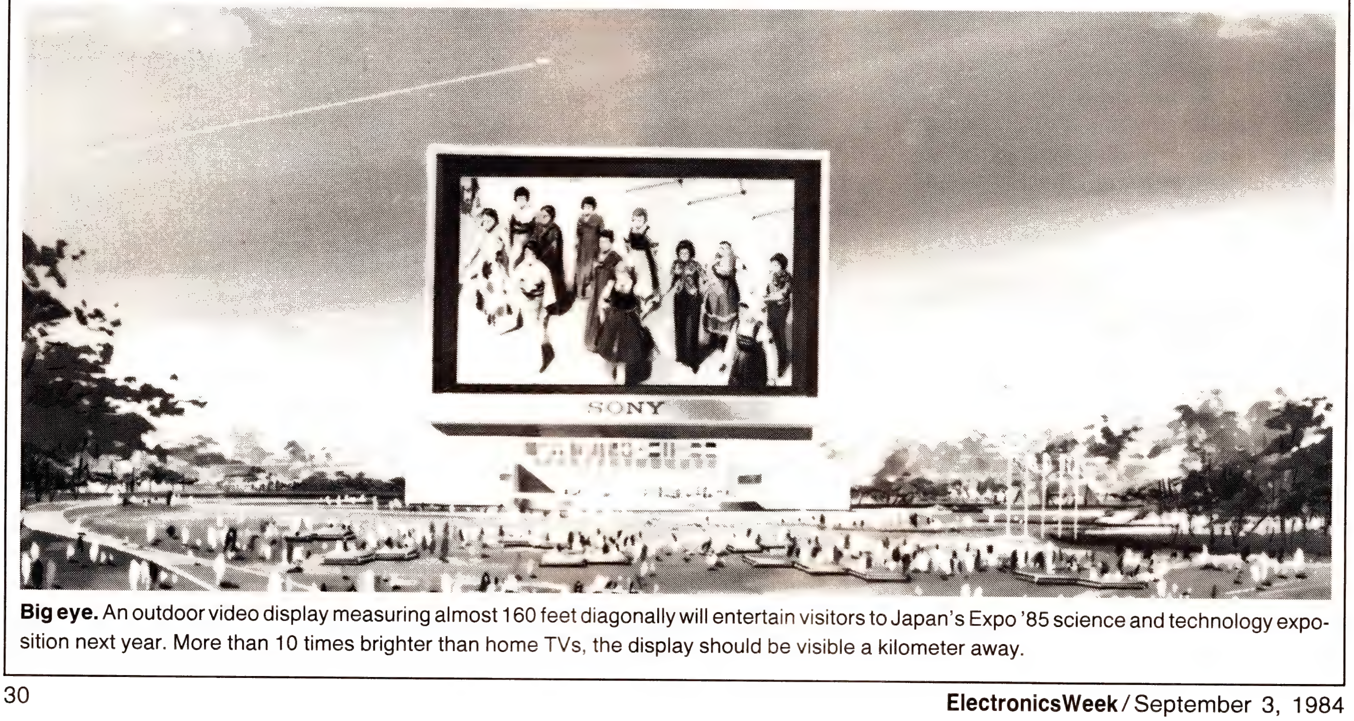
Tri-color. Large-array display cells have three electron flood sources (one for each primary color) with a common cathode.

The individual cells have three electron flood sources (one for each primary color) with a common cathode. Actual electron sources are electrons passing through individual grids, which are maintained at low positive potentials. (This type of configuration is known as a diode electron source).

Unlike conventional cathode-ray tubes in which electrons leave the gun at high velocity, all acceleration in these cells occurs as the electrons travel from the electron sources to the phosphor screen. Total accelerating voltage at the phosphor screen is about 10 kV for high brightness and efficiency.

The cells measure 8 cm wide by 4.5 cm high by 2.5 cm deep. They are bundled in 4-by-6-cell units, which are assembled to form the 40-by-25-m screen with 378 lines vertically by 400 color trios horizontally.

The new display differs from the conventional picture tube in which picture elements in alternate interlaced fields are illuminated in sequence as the electron beam scans across the screen. For starters, the signal is converted to a noninterlaced format with 60 complete frames. Moreover, processing and driving circuits convert the video signal to a parallel format with the primary-color dot of each pixel controlled by a separate 8-bit digital pulse-width-



Big eye. An outdoor video display measuring almost 160 feet diagonally will entertain visitors to Japan's Expo '85 science and technology exposition next year. More than 10 times brighter than home TVs, the display should be visible a kilometer away.

modulated signal. All dots are turned on simultaneously, and the fraction of the frame interval that each remains on is proportional to brightness. A high duty ratio makes possible the high brightness at reasonable accelerating voltage and beam current. Automatic beam-current control maintains the current at a constant value when the beam is on.

Shimada says he is particularly proud of three aspects of the display. The display tubes are designed for constant brightness despite manufacturing differences or emission slump during operation. And although the average power of 800 kW appears high, he claims that 90% of that power is in the electrons that strike the screen to produce visible emission. Moreover, he says that the display's 151,200 color trios far exceeds those of smaller billboard-like displays currently available.

Shimada says Sony has no plans for the unit after the exposition. He does note that the viewing distance from Manhattan would be perfect if the display were set up on the New Jersey Palisades. **–Charles L. Cohen**

INDUSTRIAL

Machine vision moves downscale as manufacturers adopt better lighting control and analog processing

Cambridge, Mass.—Machine vision systems are starting to filter down to smaller, less affluent users. At least that is the opinion of Perry C. West, president of Automated Vision Systems in Campbell, Calif.

"Many industrial applications for machine vision do not require the duplication of human vision capability since the tasks on the shop floor are mostly narrow and repetitious," West explained at the Machine Vision Workshop sponsored by the Society of Manufacturing Engineers held here in late August.

Accordingly, manufacturers of machine vision equipment have begun to focus on making their products cheaper. Steven Thomas, an engineer with the Training Department of Automatix in Bilerica, Mass., maintains that "extensive AI [artificial intelligence] capability may be desirable for our big customers like GM, but for the person sorting boxes in a medium-sized warehouse, AI just isn't cost-effective." Thomas sees the smaller user buying a flexible image processor like the Automatix 4 (which, disappointingly, was the only kind of machine that the SME provided at a workshop billed as "hands on") and hooking it up to a series of cheap video cameras.

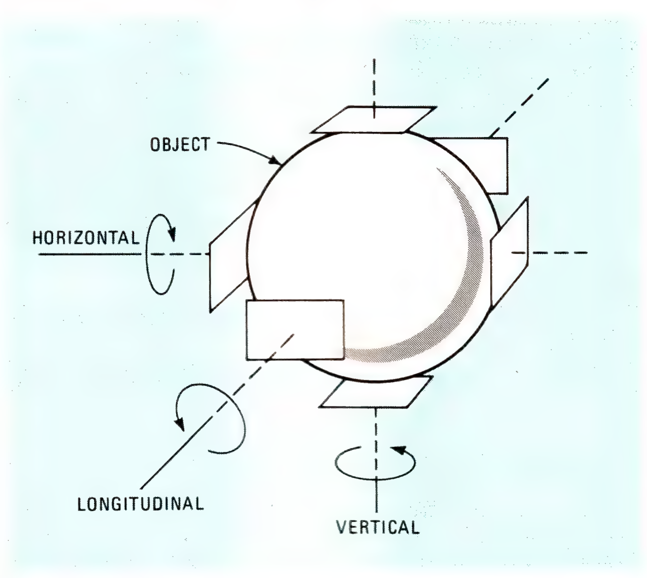
The one indispensable requirement for any machine vision system is that it recognize a user-defined feature. Usually the feature is a simple, fixed characteristic like the edge of a box or a handle, but even a fixed feature can appear differently to a machine if the lighting varies. Accordingly, West favors controlling the ambient light so that parameters like brightness and angle of incidence are well defined.

He has developed an algorithm in which light is used not only to illuminate an object, but also to define a given feature as an object passes underneath it: because light travels in a straight path, an interruption of its path by a solid object of known dimensions will cause a two-dimensional shadow to appear, whose edges correspond to the shape of a feature that the machine is programmed to recognize. Thus, the problem of pattern recognition becomes one of distinguishing light from dark—the easiest distinction for a machine vision system to make.

West cautions that recognizing an object by the light it reflects, or by its shadow, is of limited usefulness for tasks that involve inspection or assembly. But, he says, it can be the cheapest and therefore best solution for simple tasks like sorting.

Cheap 3-d. If a user needs to accomplish more than sorting, however, it is also possible to extrapolate the interplay between light and dark into a three-dimensional picture. According to Susan Gerves, president of Imaging Dimensions Inc. of Tucson, Ariz., analog circuitry is perfectly adequate for 3-d imaging. It is also cheaper to manufacture a machine vision system that bypasses the exacting production requirements inherent in digital circuits.

Imaging Dimensions has developed a system that enhances gray-scale differences (or heat differences if infrared is used) and displays them on a 2-d monitor using light intensity as a third dimension. The following analog depth cues produce the 3-d image: light reflected from an object's edges is less if the



Sharp eye. In Imaging Dimensions' system, an object is defined in terms of its axes. The relationship between any axis and the other two changes as the object is rotated, and is easily quantifiable.

object is far away; the rotation of an object (virtual or actual) appears faster if the object is closer; a line of known dimensions placed at a known distance from the imager obscures the object in a quantifiable way. The use of analog techniques also allows the system to perform real-time manipulations such as image rotation and zooming, and requires only a few knobs for control.

Gerves claims that the system, now in prototype, "will be affordable to a larger group of scientists and technical personnel than currently use 3-d imaging." Applications range from medical thermography to surface analysis. **–David M. Weber**

PACKAGING

Silicon carbide ceramic furnishes high power dissipation in a package with directly bonded aluminum interconnects

Tokyo—A new silicon carbide ceramic developed by Hitachi Ltd. offers several significant advantages over conventional substrates. This development, which is being eyed for use in high-power-dissipation packages for multiple very large-scale integrated circuits, boasts an attractive coefficient of expansion and a low rate of alpha-particle contamination.

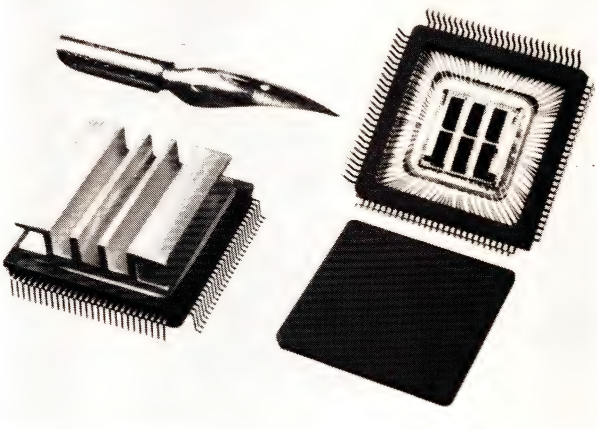
Hitaceram SC-101, as Hitachi calls its new material, is the basis of a silicon wiring board with two layers of aluminum interconnections bonded directly to the ceramic substrate. Hitachi expects to use this technology for VLSI modules that include bipolar-logic large-scale ICs, complementary-MOS large-scale integration, analog LSI, and memory chips, as well as combinations of these.

Made with a hot-press process from polycrystalline granules, this new material is superior to conventional ceramics, including beryllia and alumina, because its thermal coefficient of expansion is an almost perfect match for single-crystal silicon, allowing the silicon wiring board to be die-bonded for low thermal resistance. Conventional ceramics have about double the TCE, which tends to fracture the silicon.

Strong points. Moreover, the silicon carbide has even better thermal conductivity than metallic aluminum. Its conductivity is more than nine times that of alumina and 1.1 times that of beryllia. Other attractive characteristics of the silicon carbide ceramic include high strength, high electrical resistivity, high resistance to attack by chemical reagents, and a minimal quantity of the impurities that generate the alpha particles that cause soft errors.

A key advantage of the new package design is that conventional chips designed for wire bonding can be used without any design changes. However, an additional photolithography process is necessary to fabricate the barrier metal pads for the solder bumps. Fortunately, the barrier metal pads can be fabricated equally well on the aluminum wire-bonding pads and on the silicon dioxide at the periphery of the chip. This permits the use of a total of 80 solder bumps on each memory chip for excellent heat conduction, even though only 27 bumps are needed for electrical contact.

For the initial demonstration of the package, Hitachi engineers at the firm's Device Development Center built a 6-K memory with six 1-K bipolar memory chips in a 108-pin package. This module has an access time of 4.5 ns and a power dissipation of 6 W. Temperature rise is only 5°C/W, half that of an alumina package of the same size with the same heat fin. **–Charles L. Cohen**



Powerful. High-dissipation package for multiple very large-scale integrated circuits has a silicon wiring board with two layers of interconnections bonded to the ceramic substrate.

CONSUMER

Feature-laden home control system uses TV set as its display panel

New York—Manufacturers of TV sets like to devise new uses for their products and General Electric Co. is no exception. The Fairfield, Conn., firm is unveiling a home management system designed for easy programming through a TV set.

The system, called HomeMinder, "can virtually run the modern household—adjusting temperatures, dimming lights, turning appliances on and off at specific times, storing messages, and displaying important dates and appointments," claims Judy

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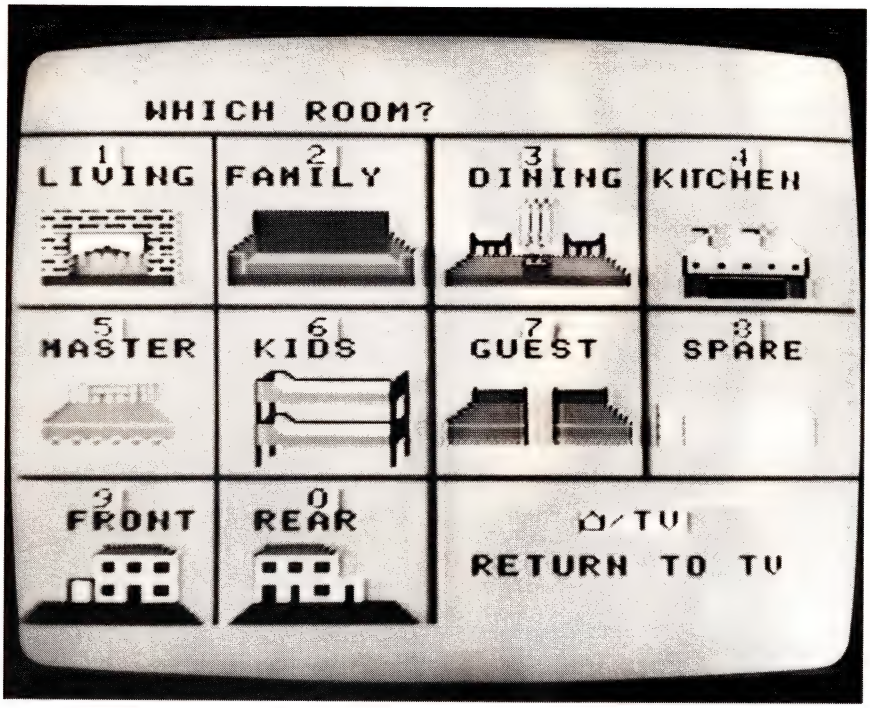


Video menu. Pictures and prompts are displayed (in color) on the TV screen. The user selects a function by pressing the corresponding numbered button on a remote handset.

Ziegler, spokeswoman at the GE Video Products Division in Portsmouth, Va.

Thanks to a production and marketing arrangement with BSR Ltd., in Blauvelt, N.Y., HomeMinder uses much of the control circuitry used in the BSR X-10, manufactured by Aztec Ltd., a BSR subsidiary in Hong Kong. But HomeMinder differs from the X-10 and other home control systems because it uses GE-developed software to display its functions on a standard TV set.

"Television occupies a central location in the home, and people are already accustomed to programming video cassette recorders from their TV," says Richard B. Williams, general manager of marketing for GE Video. "Controlling their homes from the same location is a natural transition."

When the system becomes available for the 1984 Christmas season, the suggested retail prices will be about $500 for HomeMinder and $20 each for the modules—although those figures are expected to come down as the market develops over the years and the cost of the microprocessors continues to fall. The price of other home security systems is substantially less—$300 or under—but these units are not as easy to program as the HomeMinder is.

Williams predicts that by introducing HomeMinder today, GE is taking the first step toward establishing a new market that "shows all the promise and growth characteristics of the VCR category 10 years ago."

However, other TV set makers such as RCA Corp. and Matsushita Electric Industrial Co. state that they have no plans to introduce anything comparable in the near future. At Zenith Radio Corp., John Taylor, manager of public relations, says his company's high-end System 3 television [*Electronics,* May 19, 1983, p. 42] might be expanded to accommodate many of the functions offered by GE.

To use HomeMinder, the consumer purchases a device similar in appearance to a cable hookup that connects to any TV set's rf inputs through a coaxial cable. (HomeMinder is included with GE's 25-in. component TV set). Appliances to be controlled connect to modules that plug into standard ac sockets. Control pulses are sent from the TV to the modules through the house's wiring system.

A wireless, hand-held remote control panel displays the various functions on the screen. Visuals show each room of the house, along with numbered menus of lights and appliances. Simple questions such as "What do you want to turn on?" or "Where is it?" assist the user. Items displayed on each menu are selected by pressing the corresponding number on the handset (which also sets the time and date for automatically programming appliances when the homeowner is away).

Other features include a video memo pad that remembers appointments by activating the screen at a preprogrammed time. A built-in random number generator turns lights and sound equipment on and off at irregular but plausible intervals (depending on the time of day), to give the house a "lived-in" appearance. HomeMinder can also be operated from outside the home through a tone-key phone and existing telephone wiring. **–David M. Weber**

VLSI PACKAGING

Memory makers ponder packages that will set shapes of megabit chips

Dallas—Such is the pace of their business that vendors of dynamic random-access memories already have megabit chips in the early design stage, even though the first 256-K versions are just going to market. Understandably, the memory makers are anxious to settle on one standard shape for the coming surface-mountable high-density parts. But history appears to be repeating itself, as sides are forming over what kind of package would be best.

Some firms in the business figured there would be no debate over the big chips because of the way the plastic J-leaded chip carrier caught on after it was introduced three years ago by Texas Instruments Inc. for the 64-K generation. Later, many

TI is making it happen with VHSIC.

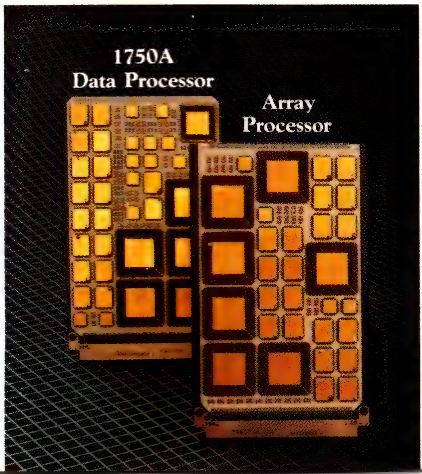
Yes, Texas Instruments is making the future happen now with VHSIC.

The first fully functional 1.25-micron VHSIC chips, operating at 25-MHz over the full military temperature range, have been delivered to the U.S. Army. Functional devices have also been delivered to the U.S. Navy, U.S. Air Force, and Defense Nuclear Agency for test and evaluation.

Current DoD funded insertion programs at TI include Pave Pillar 1750A; ICNIA; ITARS; LHX; M-1 Fire Control; and weapon guidance for IR Hellfire/JSS, TOW 2, and the Launch-and-Leave Glide Bomb. VHSIC technology at TI is also being expanded to include 0.5-micron geometries for application to future autonomous guided weapons for the Army, Navy, and Air Force.

TI is a DoD prime contractor for VHSIC Phase I development, Phase III R&D activities, the Phase II Submicron Definition Program, and is teamed with Intermetrics and IBM for the VHSIC Hardware Design and Development Language (VHD^{2}L) Program.

TI is truly making it happen now with 1.25-micron VHSIC chips and will continue to make it happen through the successful development of the Submicron Development Program.



TEXAS INSTRUMENTS

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other chip makers adopted it for 256-K parts. But TI is championing a change, with a proposal for a 300-by-675-mil small-outline J-leaded package [*ElectronicsWeek,* Aug. 13, 1984, p. 12].

The new proposal has two parallel rows of J-leads lined up on the long sides of the rectangle. Thus the package resembles the profile of conventional dual in-line packages. TI believes this configuration will simplify board layout, because it puts the control and data lines on one end and the address lines at the other.

Along with TI, the package has another very big backer: IBM Corp., Armonk, N.Y., which was a participant in TI's development program last year. Nevertheless, the long, narrow package worries some major U.S. memory suppliers, in particular, Intel Corp. and Motorola Inc.

Intel has made a proposal to adopt a chip carrier measuring 350 by 550 mils with 28 J-leads as the 1-Mb-by-1-bit standard to the Joint Electron Device Engineering Council's 43.2 memory committee, which will meet later this month. That package has already received approval from the committee for future (64-K-by-4-bit) static RAMs. Motorola, in fact, is designing a 1-Mb chip to fit into the 28-lead chip carrier.

Of key import is die layout for the 1-Mb chips, which cannot go much further until companies settle on a basic packaging shape, according to many Jedec panel members. Chip designs for one package will not be suitable for the other.

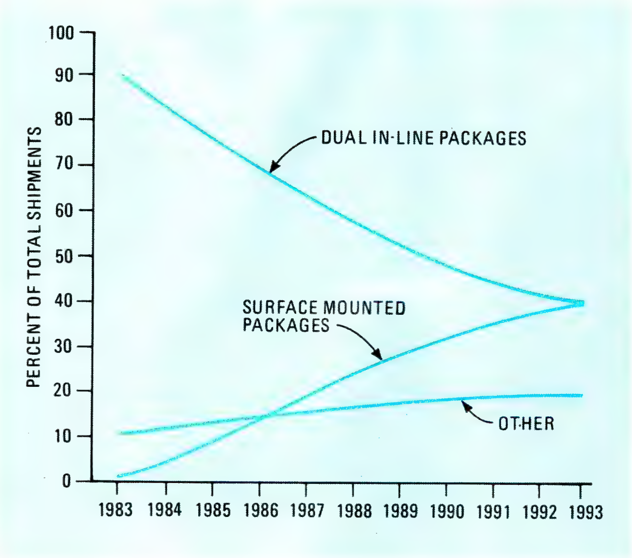
Nearly everyone agrees, too, that two emerging standards would be disastrous for a market that relies so heavily on huge volumes to drive yields up and prices down. When one package finally does take hold, backers of the other will risk extinction in the competitive RAM arena.

To fit into the 300-mil-wide package, the die must be elongated. Taking into account the maximum 180-mil width, most megabit chips would be stretched to 450 to 500 mils. Many designs already underway will not fit that configuration.

"The feeling is that 300-mil-wide DIPs will eventually show up in the megabit markets," says Intel's Patrick Brooks, product manager in Hillsboro, Ore. "The problem is that even though everyone would like to fit [his chip] into 300-mil packages, not all will at first." Brooks believes there will be some attempts to set *de facto* market standards with early introductions of 400-mil-wide DIPs. All this notwithstanding, Brooks foresees no problems in packaging existing chip designs into the surface-mountable 350-mil-wide chip carrier proposed by Intel.

Intel believes a substantial portion of megabit RAM volumes will still be shipped in DIPs, but mostly to customers using them in small quantities in their systems, says Brooks. TI estimates that surface-mountable packages will account for the majority of megabit chips shipped. In total U.S. DRAM shipments, it says, DIPs will be surpassed by surface-mountable packages by 1993 (see figure).

Motorola memory officials are concerned that the extreme aspect (length-to-width) ratio nececssary for chips fitting in the TI package could result in lower yields, reliability, and performance. Elongating chip designs would mean placing word lines in memory arrays much closer together. This would increase the risk of defects in volume production, suggests Betty Prince, strategic marketing manager for MOS memories, in Austin, Texas.



Ups and downs. In TI's view, DIPs will wane during the next decade as surface-mounted types rise from near zero to a 40% share.

Both Motorola and Intel are concerned about the impact of switching forms after the plastic leaded chip carrier has finally achieved the 256-K level. Standardizing chip carriers for all memories will also allow vendors to "avoid duplication of tooling equipment, testers, and burn-in boards; thereby decreasing cost," Prince notes. But TI is considering a 400-mil-wide J-leaded package for other chips, such as byte- and word-wide memories. –**J. Robert Lineback**

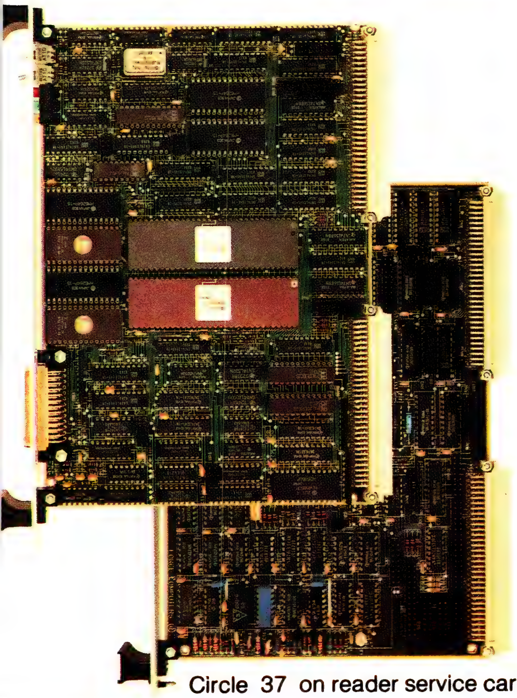
IC PROCESSING

Dry-etched controlled profiles improve step coverage on wafer

Albuquerque, N.M.—In spite of its being the dominant technique for fabricating integrated-circuit patterns in semiconductor processing, plasma etching nonetheless could be bettered, particularly in the step coverage of thin films deposited over the silicon dioxide and polysilicon lines that make up on-chip transistors, diodes, and capacitors.

Such coverage is essential to ensure reliable ICs, so commercial chip makers are striving to better their etching techniques. So is the Sandia National Laboratories, which has an added concern: radiation hardness.

Sandia's solution is to control the profiles of the etched lines, tapering them so that their shape in cross-section is a trapezoid. Commercial



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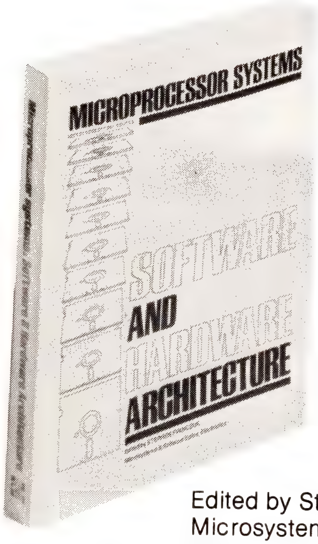

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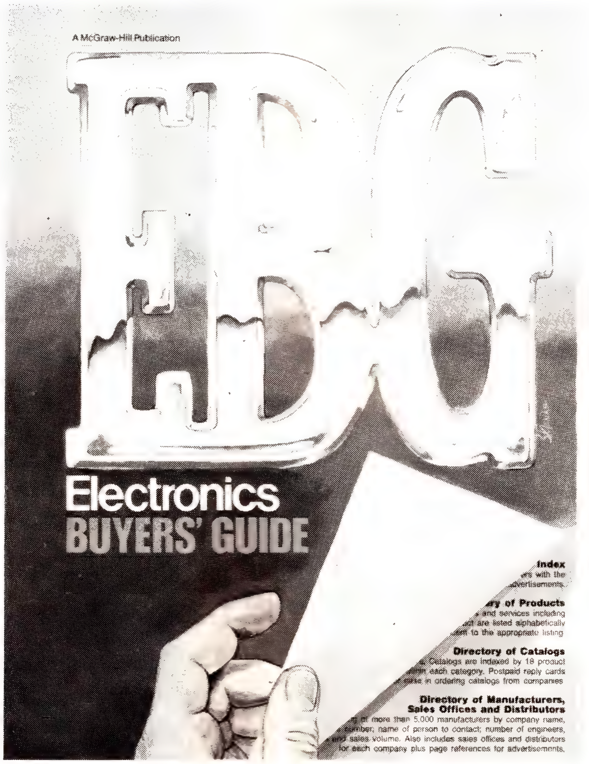
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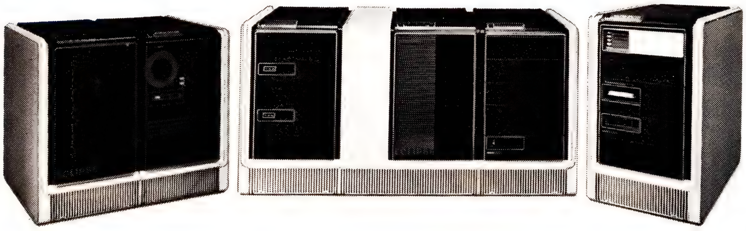

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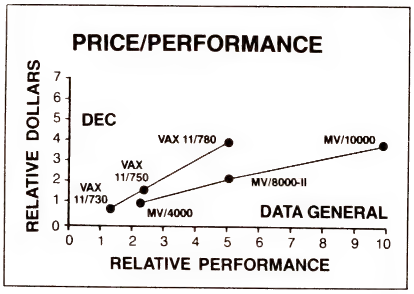

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semiconductor houses almost surely are taking a similar tack, but they aren't asking anyone to come up and see their etchings. The Albuquerque institute, supported by public funding, doesn't keep its basic research findings secret.

Dome shape. Sandia researchers make the tapered shapes by treating photoresist patterns before plasma etching, explains Douglas L. Weaver, who heads fabrication operations in the IC Processing Division at Sandia's Center for Radiation-hardened Microelectonics. The wafer is heated to 140°C for 30 min and this causes the resist to dome up so that it cannot be etched away completely (see drawing).

The Sandia group also zeroed in on plasma-etching studies to ensure that their techniques using ionization to turn gas into a plasma would not interfere with radiation-hardening processes. (Sandia provides hardened complementary-MOS circuits to a number of military projects.)

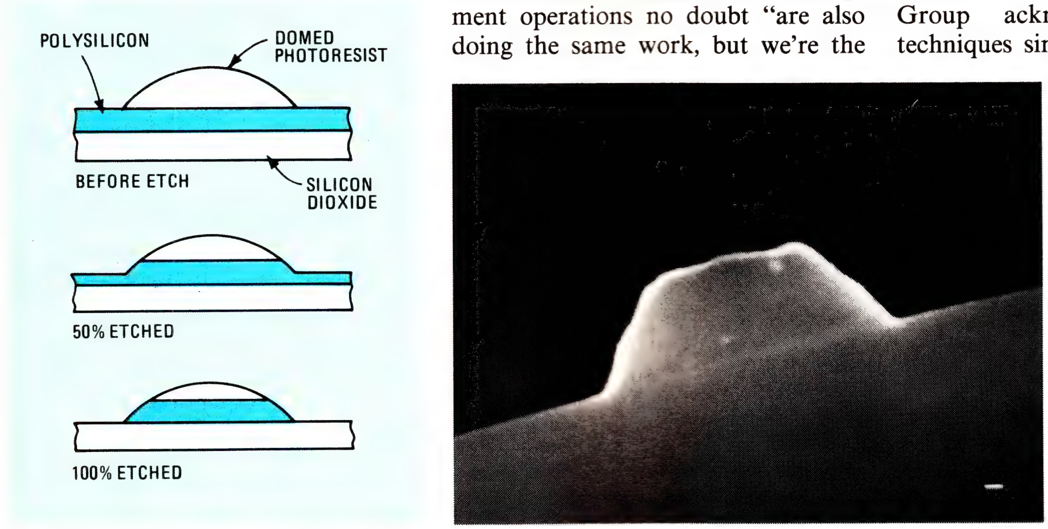
Actually, the tapering boosts radiation hardness because it eliminates the entire high-temperature (about 1,000°C) processing step called reflow, which often breaks down radiation-hardened properties. Commercial IC manufacturers routinely melt silicon dioxide as a smoothing technique on the wafer surface to improve step coverage.

In Weaver's opinion, other leading semiconductor research and development operations no doubt "are also doing the same work, but we're the only ones talking about it." He notes that the plasma-etching work has gone far beyond the laboratory stage at Sandia, which already has produced a significant number of parts using it.

Full tilt. Major semiconductor houses indeed are charging full tilt into plasma-etching improvements, says Gerald Worchel, staff consultant at processing advisor Integrated Circuit Engineering Corp., Scottsdale, Ariz. Their motivations are clear: "As geometries keep shrinking, step coverage becomes more important."

Most are keeping mum, but one major vendor is willing to divulge a little about its plasma-etching work. Motorola Inc.'s Semiconductor Group acknowledges developing techniques similar to Sandia's.

"It's a good piece of work with a reasonable technique," says James N. Smith, manager of process technology at Motorola's Semiconductor R&D laboratory in Phoenix. Makers of chips with geometries of from 1 to 3 μm can find the tapered profile useful in improving step coverage, he notes, but not for future parts with submicrometer features. –**Larry Waller**



Dome. Heating the wafer to 140°C for half an hour causes the resist to bulge. It cannot be etched completely, so the polysilicon lines wind up having tapered edges. The slight cap of resist that remains is removed by solvent.

COMMUNICATIONS

Spread-spectrum techniques for nationwide paging shake off earth's bonds to reduce costs sharply

Santa Monica, Calif.—A landmark commercial application of spread-spectrum technology is now on the drawing boards at PageMemo Inc. The Santa Monica firm, which is one of three selected by the Federal Communications Commission to set up the new 900-MHz service, is hoping to get a jump on its competitors by using the technology.

But there's a problem looming for PageMemo: if the company's supplier, Equatorial Communications Co., Mountain View, Calif., has its way, all three firms chosen by the FCC will be using its spread-spectrum design—resulting in greater profits for Equatorial but denying PageMemo its exclusivity.

Cost benefits. The main advantage of the spread-spectrum technique "is that it frees us from terrestrial circuits and their associated costs," according to PageMemo's president, Lawrence Rogow. Because of the technique's favorable interference-rejection properties, antennas 2 ft in diameter can be used at the same site as the transmitters. With the stations costing only $3,000 each (compared with about $10,000 for a 10-ft C-band antenna) and with the ability to bypass links between the ground station and transmitters, Rogow estimates that PageMemo's customers thus "will get away with an average bill of $12 per month."

The designs of the two other paging operators—Mobile Communications Corp. of America, Jackson, Miss., and CyberTel-Cox Beep USA Nationwide Paging, in Fairview Heights, Ill.—also envision satellite distribution, but by conventional frequency modulation [*Electronics-Week*, Aug. 27, 1984, p. 18]. Their systems require the larger C-band antennas, and a terrestrial link to send the satellite signal to local transmitters.

"Those costs are going to kill their service," contends John Keyes, special project manager for Equatorial Communications. "Once they see how much cheaper and efficient our system is, there will be no choice but to buy it," he predicts.

As it will work for PageMemo, messages called into its central switching facility in St. Louis will be verified, processed for billing, and then retransmitted to Equatorial's master earth station. There, every message is packed into a 19.2-kb/s baseband signal prior to uplink. Each bit is coded into 128 pieces, called chips, which are transmitted through a conventional frequency modulation technique as if they were a bit.

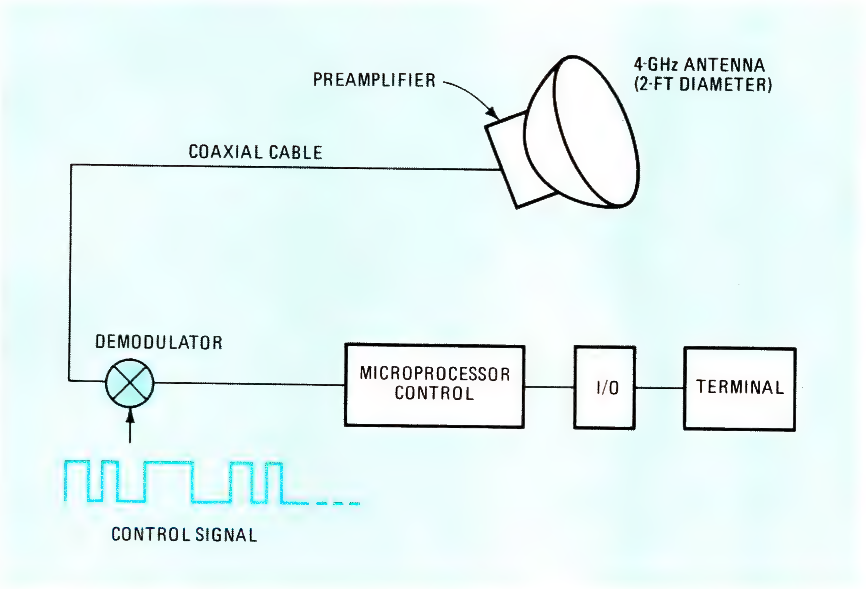
For example, each phase of a binary-phase-shift key represents a chip in spread-spectrum transmission, whereas it would be an entire bit in narrowband. The higher occurrence of chips per bit of information spreads the carrier at a rate of 5 MHz.

The incoming chips of the spread-spectrum signal are ordered in a pseudo-random sequence. Each receiver contains a filter matched to the characteristics of the transmitter; the filter performs pattern-recognition analysis to extract the bits of the original message. The page is then transmitted at 900 MHz. At that frequency, Equatorial guarantees a bit-error rate of no more than one in 10 million.

Tradeoffs. The disadvantage of small earth stations is that they require a large beamwidth—9° with the 2-ft dish, versus a 1.6° focus with a 10-ft dish. "The 9° gets plenty of interference from other satellites and terrestrial microwave, but with spread-spectrum it just isn't a problem," contends Keyes.

Of course, when the price of equipment is lowered on earth, it increases in space, says Keyes. But he adds that when the expense of earth stations is predominant, "it pays to spend more in space to drive down overall network costs."

Although PageMemo is the only national paging operator to sign a contract with Equatorial, Keyes believes that the only barrier to getting the two others on board is "lack of knowledge about what spread spectrum can do for them." While MCCA seems intent on sticking with its original system design, the Cox consortium reports it is reevaluating its transmission plans.–**Karen Berney**



Small dish. Because spread-spectrum transmission has excellent interference rejection, PageMemo can get away with $3,000 stations having antennas only 2 ft in diameter.

MILITARY

New quality-control problems arise for Hughes in dispute with military over faulty radar system

El Segundo, Calif.—"Navy" is becoming a nasty word among nervous military contractors following the discovery of new quality control troubles at Hughes Aircraft Co., the Defense Department's ninth-ranked contractor in annual dollar awards. The latest Navy challenge to Hughes' product quality was aimed at the Radar Group, located here, within weeks of similar complaints by the service regarding airborne tactical missiles built by Hughes at a Tucson, Ariz., plant [*Electronics-Week,* Aug. 20, 1984, p. 18].

Alerted by the fact that some parts for the F-14 aircraft's radar were produced at the troubled Tucson facility and shipped to El Segundo, Navy investigators tore down samples of the AN/AWG-9 radar and found such signs of poor manufacturing techniques as loose screws, bad soldering, and debris—including metal filings—within the radar housing, according to service representatives.

When the Air Force also expressed concern about the Hughes-built radars used in two of its aircraft—the APG-63 radar system in

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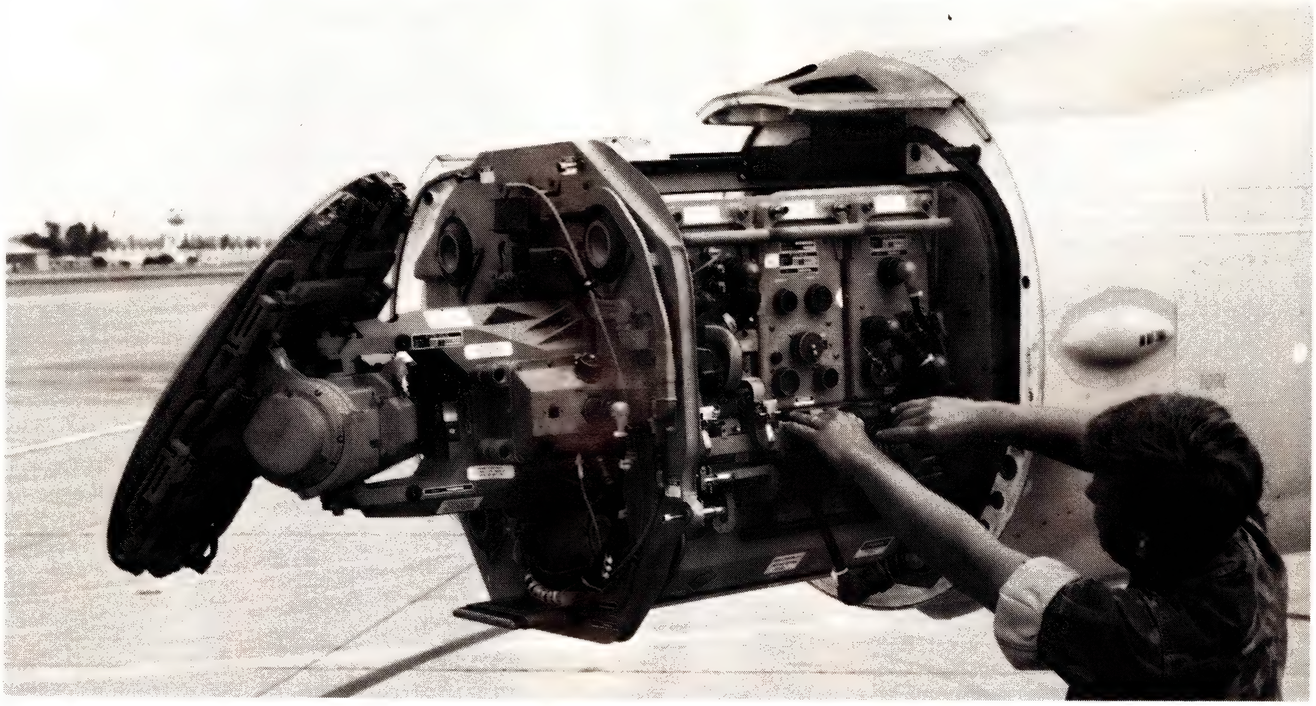


Faulty fabrication. The APG-65 radar unit used in the F/A-18 jet is one of the radar systems made by Hughes Aircraft Co. under scrutiny by the U.S. Navy. The service, which claims it has found instances of poor manufacturing practices, is criticizing the firm's management controls.

the F-15, and the APG-65 in the F/A-18—the company voluntarily suspended deliveries of all three systems. One Navy official claims Hughes' action "was taken only because we would have ordered suspension [of the Navy's systems] if they didn't act."

The Tucson plant's earlier problems with quality in its airborne missiles—the Navy's Phoenix, the Air Force's Imaging Infrared Maverick, and the Army's TOW antitank missile—led to suspension of military acceptance of the three missiles until quality-control issues are resolved and the cancellation of progress payments on all three programs. In July, according to the DOD, those payments totaled $38 million.

Following a product review of all three missiles by a team of Air Force officials, the service's Contract Management Division at Kirtland Air Force Base, N.M., which administers all three missile programs, reported 68 separate findings of quality deficiencies in the Tuscon operation's production. Among the deficencies cited by the CMD were "poor workmanship, inadequate translation of engineering specifications to production planning, failure of manufacturing personnel to follow planning documentation, and, most importantly, failure of management to ensure the flow-down of contractual requirements to operating levels." In short, says one officer, "The Hughes management at Tucson failed for some reason to let its people know precisely what they were responsible for."

Quality advocate. Willis J. Willoughby Jr., Deputy Chief of Naval Material for reliability, maintainability, and quality assurance, has been identified as the instigator of the drive to toughen quality-control enforcement. But Willoughby, regarded by the industry as an outspoken advocate of strong quality standards for weapons and less bureaucratic paperwork, was not available for comment on the reports.

Willoughby's uncharacteristic silence has led to speculation that he is saving his observations for the Department of Defense's top brass and, possibly, for a later congressional investigation, if that step should be called for.

Beyond the loss of progress payments on the missile programs, the Hughes Tucson facility has 90 days from the initial suspension on August 3 to develop acceptable quality-control procedures or face decertification of the plant as a production facility. Military sources say privately that they doubt that drastic final step will be taken, because of the extended time and multimillion-dollar cost required to develop a new contract production plant to be paid for with DOD funds.

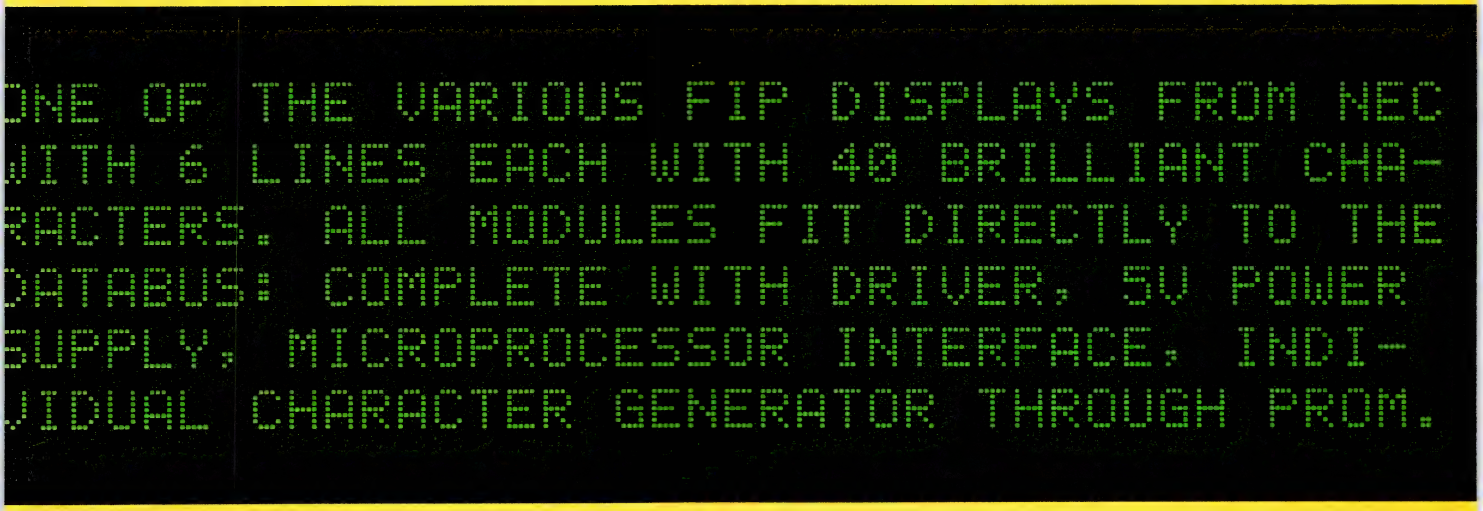
As for Hughes, the firm is making no public statement whatsoever on the suspension of the three radar systems. But the next step the company takes evidently depends on the release of results of a Navy auditing team that recently visited the El Segundo radar plant. The team's report is being filed with the Naval Air Systems Command and information concerning the findings should soon be available.

While sloppy workmanship, not performance, has so far highlighted the troubles uncovered in the three airborne radar systems, sources note the radars undergo more extensive testing than missiles and must be repaired if they don't work. Nevertheless, one Navy engineering official points out that sloppy workmanship can significantly shorten a radar system's operational time before maintenance is required.

It is clear that the Tucson missile now affects the 6,500 workers in Arizona and some 10,000 at the Radar Group. According to industry sources, a military audit team has been at the Hughes Electro Optical Data Systems Group, also in El Segundo. The company will not comment on the report. **–Ray Connolly**

NEC

Illuminating Example.



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ATABUS: COMPLETE WITH DRIVER, 5V POWER
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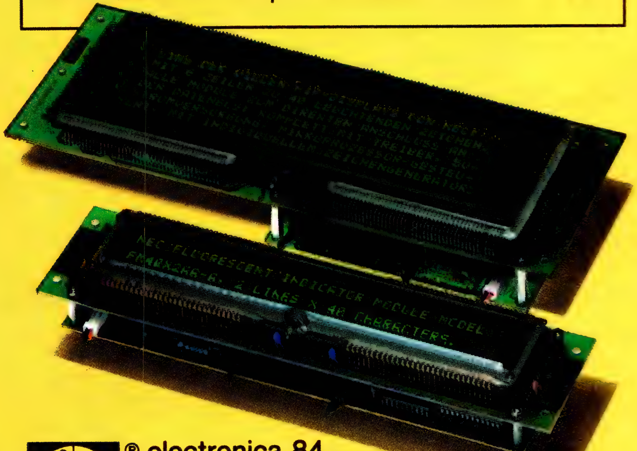
From the NEC catalogue of FIP® Modules

Model	Number of Lines	Characters per Line	Character Size (mm)
FM20X1AA-B	1	20	5.05 x 3.55
FM20X1DB-A	1	20	9.00 x 6.30
FM40X1AA-A	1	40	5.05 x 3.55
FM40X2AA-A	2	40	5.35 x 3.55
FM40X6AA-A	6	40	5.00 x 3.50
FM80X2AA-A	2	80	3.50 x 2.05
FM180GX48AA-A Graphics Module with 180 x 48 dots			



Where you simply demand too much from LCDs the **FIP® Displays** (Vacuum fluorescent indicator panels) from NEC show their strengths: at diffuse light, even in the dark – and unimportant from which viewing angle. On top of that they are highly reliable during their whole long life-cycle, and they have a low power consumption.

What has been standard for video recorders since longtime makes your valuable equipment even more precious in the user's eyes: the brilliant display of data and information. And to save you the trouble of costly developments we offer the **FIP® Modules** as complete units – ready for fitting and with everything you need: **FIP® Display,** 8-bit microcomputer, driver, and generator for 128 characters or even for graphics. You choose out of the various models – and connect it like a terminal directly to the data bus of your equipment.

The **FIP® Modules** come with the proven quality of all NEC products: best reliability thanks to the highly automated production process, great functionality as a result of innovative design.

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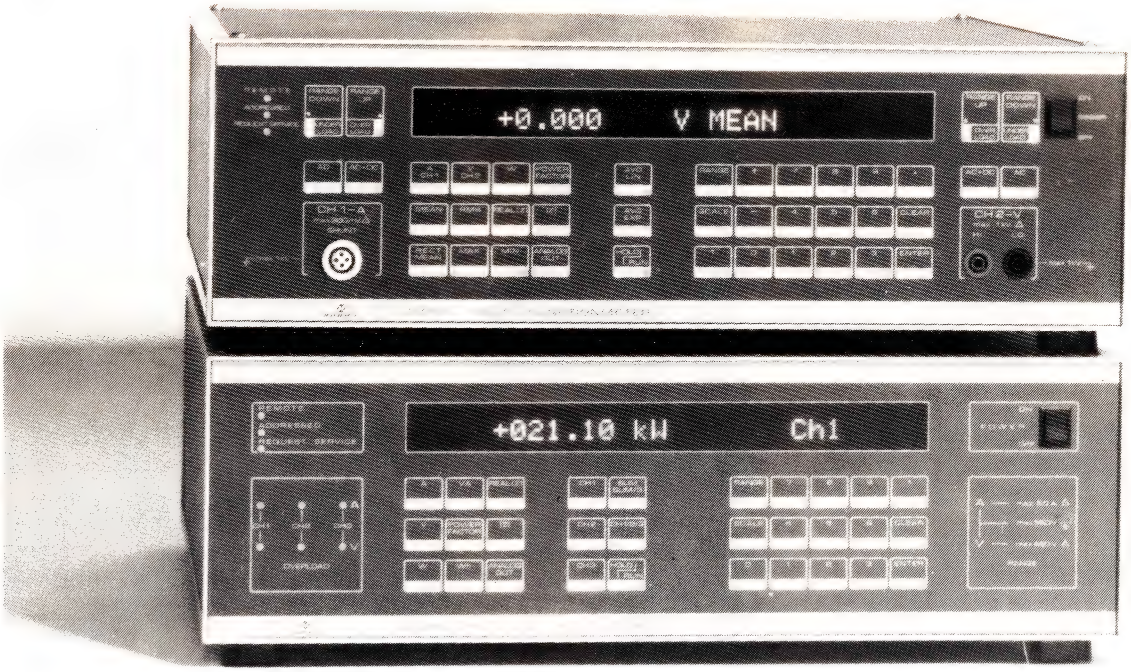

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AC POWER ANALYZER D 5155
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# of NORMA

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AC POWER ANALYZER D 5155
(PRECISION WATTMETER)
The new AC POWER ANALYZER D 5155 takes three-phase measurements of active power, apparent power, power factor, energy, active resistance, impedance, current and voltage.
Up to 32 values are obtained from a single measuring cycle (e. g. summation values). The wide scope of ranges 65 V – 650 V and 0.1 A – 50 A as well as the high accuracy of **0.1**% assure a wide range of applications in single-phase or polyphase systems.

AC/DC POWER ANALYZER D 5135
(MULTI-FUNCTIONMETER)
The new AC/DC POWER ANALYZER D 5135 measures DC, AC and mixed quantities. For current and voltage, arithmetic mean, rectified mean and TRUE RMS values are obtained, supplemented by active power, power factor, active resistance and impedance.
The instrument measures DC components, AC components with their harmonics up to 100 kHz and the summation values.

User-Friendly
Microprocessors compute the measured values, check input and control the measuring cycles. Remote control is effected by IEEE 488 or IEC 625 Interface. An analog output permits graphic recordings of measured values.

Wide range of applications
The accents are measurements in the field of power electronics, on motors, generators, transformers, welders, phase controls, power supplies, ballast devices etc.

Successfull meters with systems capability of NORMA

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D 4025 IEC 625	PRECISION MULTIMETER	0–2,5 A / 1000 V / 25 MOhm
D 4045 RMS IEC 625	PRECISION MULTIMETER	0–2,5 A / 1000 V / 25 MOhm
D 4135 IEC 625	MULTI-FUNCTIONMETER	0–150 kA / 500 V 75 MW
D 4155 IEC 625	PRECISION WATTMETER	0–10 A / 550 V / 11 kW
D 5155 IEC 625	AC POWER ANALYZER	0–50 A / 650 V / 100 kW
D 5135 IEC 625	AC/DC POWER ANALYZER	0–100 A / 500 V / 50 kW
MS 5995 IEC 625	MULTI-SCANNER	up to 80 channels; 10 A / 1000 V

A leader in meter design
New technologies, state-of-the-art design and more than 60 years experience in electrical measuring instrument manufacture combine to guarantee quality and reliability.

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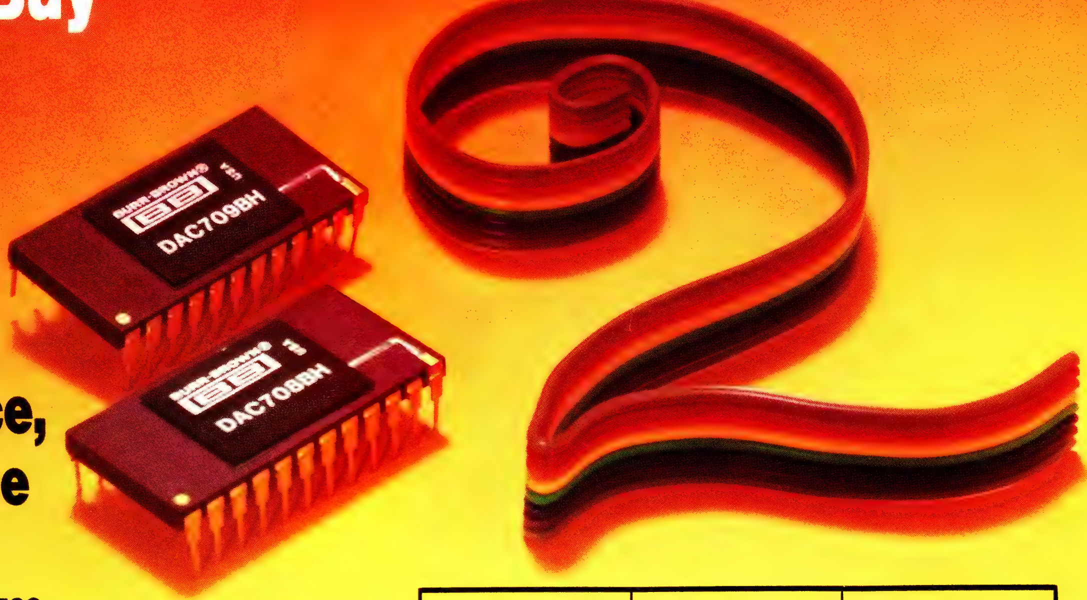
The Two And Only Complete μP-Compatible 16-Bit DACs You Can Buy



Save Parts, Board Space, Design Time

DAC708 And DAC709

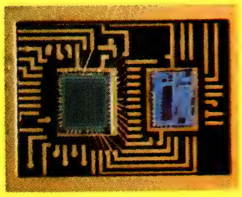
Introducing two new 16-bit digital-to-analog converters, each complete with reference and latches (and V_{out} op amp for DAC709), all in one package. Bipolar input coding is Binary Two's Complement. A CLEAR function resets the converters to bipolar zero at the output. They're ready to interface directly to any 8-bit bus or will accept a serial input. Choose voltage or current output models.

Fast, Accurate Performance

Efficient design, precision processing reduces linearity error to ±0.003% FSR. Devices are monotonic to 14 bits over the specified temp range.

Unique Two-Chip Design

We used the best technology for each job: fast CMOS for the gate array logic latches, thin-film bipolar for linear functions.



Specifications	DAC708	DAC709
Resolution	16 bits	16 bits
Bus Compatibility	8-bit parallel or serial	8-bit parallel or serial
Linearity error (max, over spec temp)	±0.003% FSR	±0.003% FSR
Monotonicity (min, over spec temp)	14 bits	14 bits
Gain Drift, max: BH KH	±15ppm/°C ±25ppm/°C	±15ppm/°C ±25ppm/°C
Settling to ±0.003% FSR	8μsec, max	8μsec, max
Output Range:		
Unipolar	0 to −2mA	0 to +10V
Bipolar	±1mA	±10V, ±5V
Package	Hermetic 24-pin DIP	Hermetic 24-pin DIP

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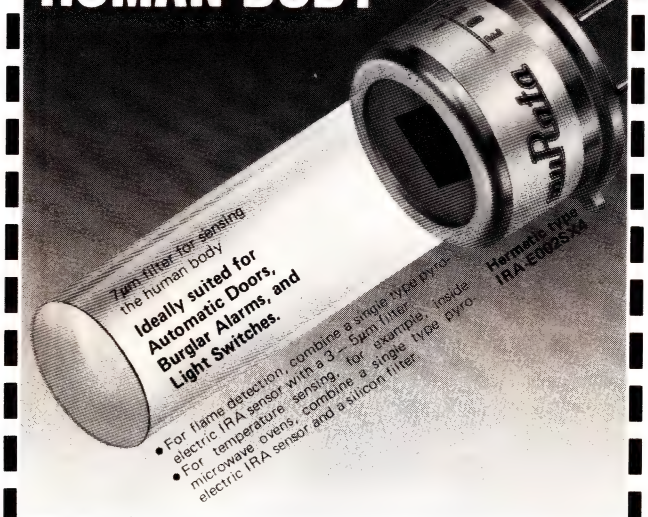
MURATA'S IRA SENSOR SECURELY DETECTS HUMAN BODY

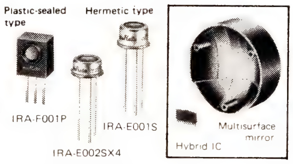

muRata
7µm filter for sensing the human body
Ideally suited for Automatic Doors, Burglar Alarms, and Light Switches.
• For flame detection, combine a single type pyroelectric IRA sensor with a 3 – 5µm filter.
• For temperature sensing, for example, inside microwave ovens, combine a single type pyroelectric IRA sensor and a silicon filter.
Hermatic type IRA-E002SX4

MURATA's IRA sensor is incomparably reliable, securely detecting human bodies in any environment.

Murata's pyroelectric IRA sensor correctly and securely detects intruders in any environment, even in direct sun light and in the presence of deflected light.

Pyroelectric IRA sensors need no cooling. Also, a variety of window materials are available.

Unlike quantum type sensors, MURATA's pyroelectric (thermal) infrared sensors need no cooling. They correctly function in normal temperatures and can be applied to a variety of uses, featuring low price and durable life. Also, they are available in kits, each combined with a multisurface mirror and a hybrid IC that amplifies the sensed signals.



Typical pyroelectric IRA sensors (at 25°C)

Types	Sensitivity (500°K,1Hz,1Hz)	Wave length response range	Visual angle	Window materials
IRA-E002SX4	115V/W	7µm minimum	θ1=47° θ2=54°	Long-pass silicon
IRA-F001P	55V/W	1-20µm	80°	Polyethylene
IRA-E001S	45V/W	1-20µm	70°	Silicon

* Specific detectivity at 500°K, 1Hz, is rated to be −1 x 10°cmHz1/2W^{-1} for all types shown above.
* Rise time is rated at 25msec. for all types shown above
* Effective temperature range: −20° to +70°C. for IRA-F001P and IRA-F002SX4, and −20° to +80°C for IRA-E001S

Using pyroelectric ceramic elements, low-price and superb sensitivity have been realized.

PYROELECTRIC INFRARED SENSOR

For details of IRA sensor techniques, ☎ directly

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Sliding fuse holder: smaller low cost

touch proof · high quality

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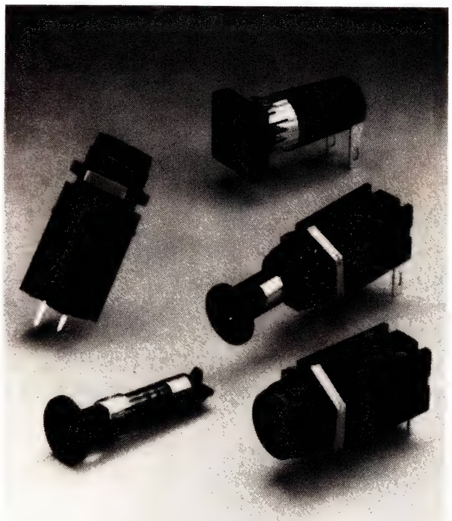

- Low cost fuse holder for front panel and circuit board mounting.
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- Compact design, low profile for pcb mounting and reduced depth for front panel mounting.
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- Vertical fuse holders can be mounted side by side on a 12,5 mm pitch.
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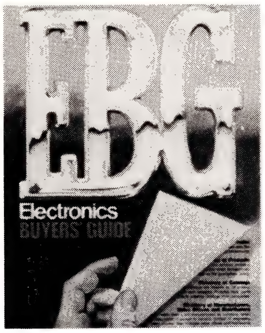

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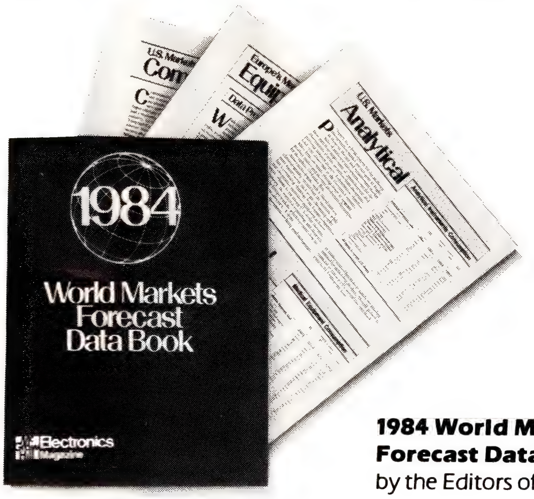

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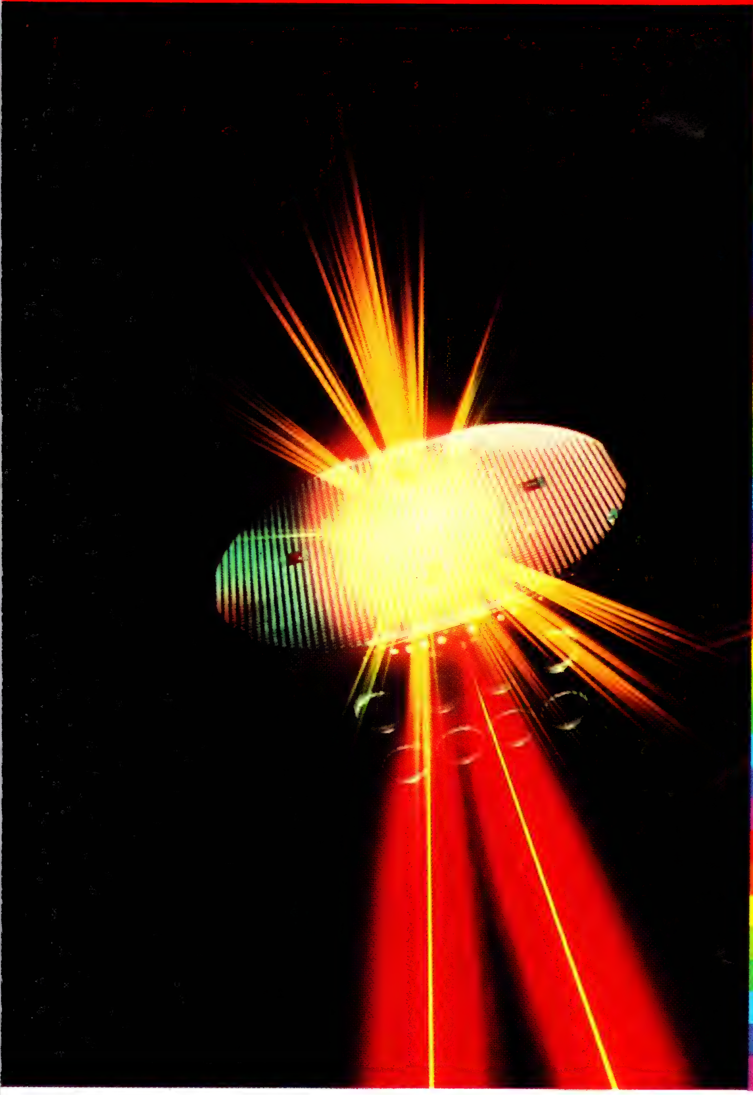

97 High speed CMOS types:

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HCT20	Dual 4-Input NAND Gate
AND GATES	
HC/HCT08	Quad 2-Input AND Gate
HC/HCT11	Triple 3-Input AND Gate
INVERTERS/BUFFERS/BUS DRIVERS	
HC/HCT04	Hex Inverter
HC/HCT365*	Hex Buffer/Line Driver; 3-State
HC/HCT366*	Hex Buffer/Line Driver; 3-State; Inverting
HC/HCT367*	Hex Buffer/Line Driver; 3-State
HC/HCT368*	Hex Buffer/Line Driver; 3-State; Inverting
HC4049	Hex Inverting HIGH-to-LOW Level Shifter
HC4050	Hex HIGH-to-LOW Level Shifter
FLIP-FLOPS (POSITIVE-EDGE TRIGGERS)	
HC/HCT74	Dual D-Type Flip-Flop with Set and Reset
HCT173*	Quad D-Type Flip-Flop; 3-State
HC/HCT174	Hex D-Type Flip-Flop with Reset
HC/HCT175	Quad D-Type Flip-Flop with Reset
HC/HCT273	Octal D-Type Flip-Flop with Reset
HC/HCT374*	Octal D-Type Flip-Flop; 3-State
HC/HCT534*	Octal D-Type Flip-Flop; 3-State; Inverting
HCT564*	Octal D-Type Flip-Flop; 3-State; Inverting
LATCHES	
HC/HCT373*	Octal Transparent Latch; 3-State
HCT533*	Octal Transparent Latch; 3-State; Inverting
HC563*	Octal Transparent Latch; 3-State; Inverting
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HC/HCT161	4-Bit Binary Counter; Asynchronous Reset
HC/HCT162	BCD Decade Counter; Synchronous Reset
HC/HCT163	4-Bit Binary Counter; Synchronous Reset
COUNTERS	
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HC4024	7-Stage Binary Ripple Counter
HC/HCT4040	12-Stage Binary Ripple Counter
HC/HCT4518	Dual Synchronous BCD Counter
HC/HCT4520	Dual 4-Bit Synchronous Binary Counter
HC/HCT40102	8-Bit Synchronous BCD Down Counter
HC/HCT40103	8-Bit Binary Down Counter
MULTIPLEXERS	
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HC/HCT251	8-Input Multiplexer; 3-State
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DECODERS	
HC/HCT138	3-to-8-Line Decoder/Demultiplexer; Inverting
HC/HCT139	Dual 2-to-4-Line Decoder/Demultiplexer
HC/HCT154	4-to-16-Line Decoder/Demultiplexer
HC/HCT238	3-to-8-Line Decoder/Demultiplexer
HC/HCT4514	4-to-16-Line Decoder/Demultiplexer with Input Latches
HC/HCT4515	4-to-16-Line Decoder/Demultiplexer with Input Latches
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HC/HCT243*	Quad Bus Transceiver; 3-State
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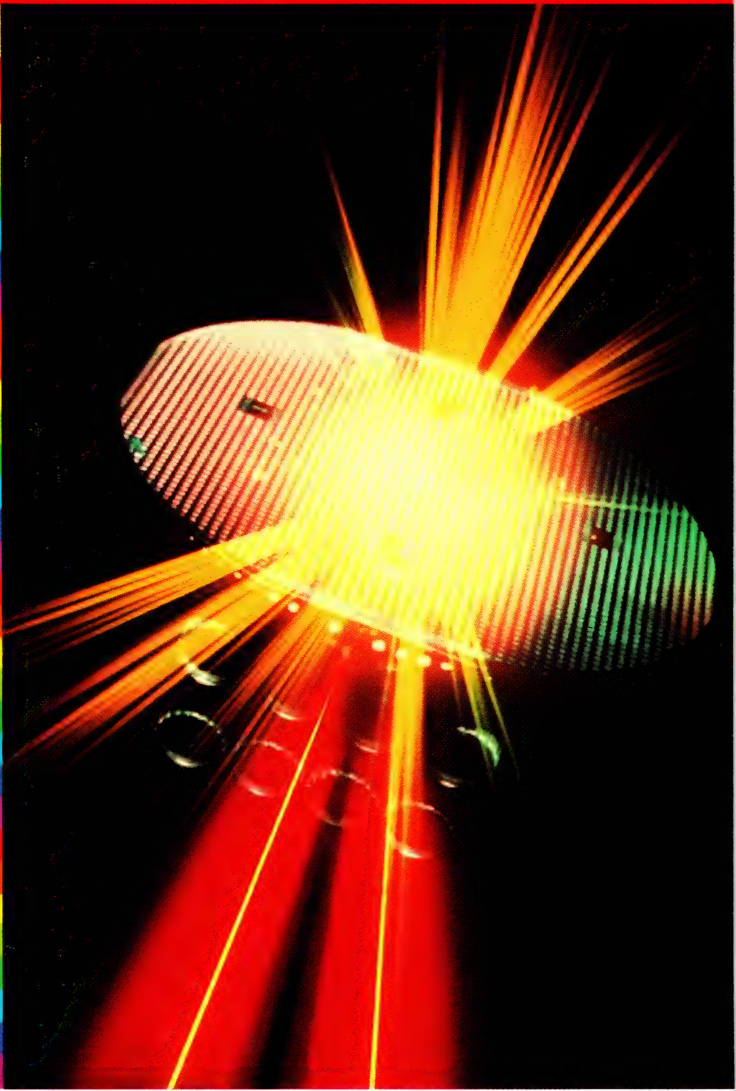
*Types with a bus driver output stage.



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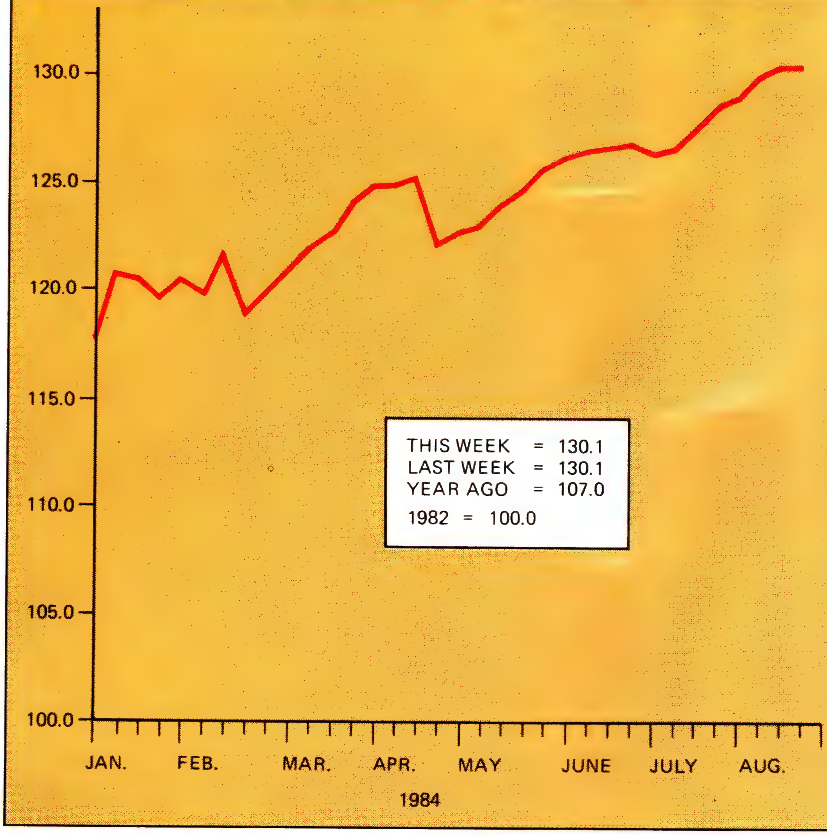

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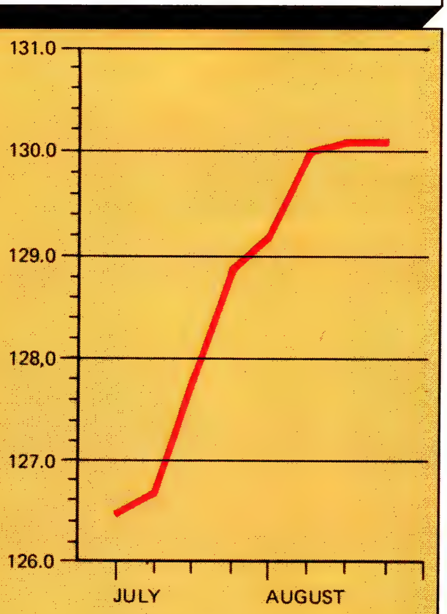
LAST WEEK = 130.1
YEAR AGO = 107.0
1982 = 100.0



The *ElectronicsWeek* Index, a seasonally adjusted measure of the U.S. electronics industry's health, is a weighted average of various indicators. Different indicators will appear from week to week.

U.S. ELECTRONIC COMPONENTS PRODUCER PRICE INDEX (1967=100)

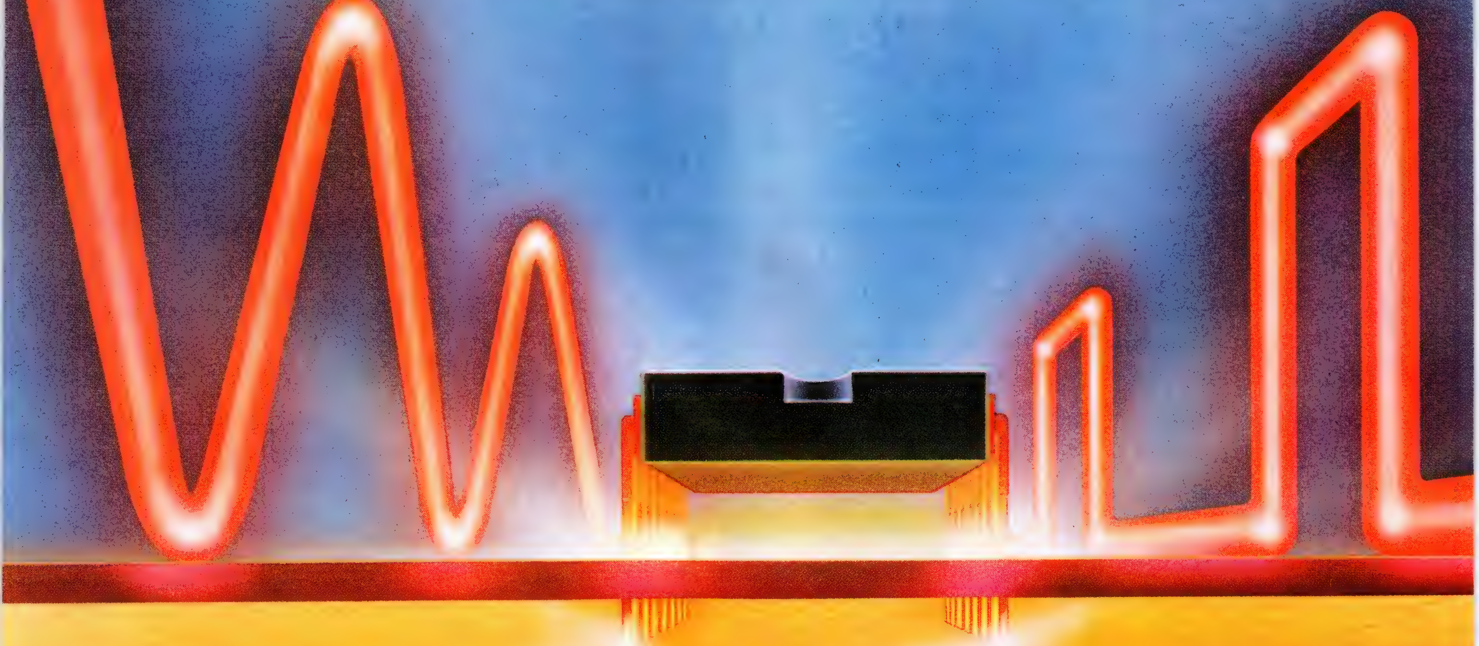
	July 1984	June 1984	July 1983
Digital bipolar integrated circuits	63.1	62.9	62.6
Digital MOS ICs	42.9	43.4	41.4
Linear ICs	65.8	66.0	62.8
Capacitors	190.6	190.4	193.2
Resistors	185.1	181.6	185.2
Relays	319.1	319.1	301.2
Connectors	228.8	228.5	223.4

U.S. GENERAL ECONOMIC INDICATORS

	July 1984	June 1984	July 1983
Average prime rate (%)	13.00	12.58	10.50
Retail sales ($ billions)	107.807	108.782	98.832
Unemployment rate (%)	7.4	7.0	9.3

With prices of electronic equipment remaining generally unchanged, the *ElectronicsWeek* Index held steady for the latest week. For the most part, inflation in the U.S. appears to be under control, as demonstrated by a scant 0.3% increase in consumer prices in July. At the same time, orders for durable goods advanced 2.2% in July, indicating that a general slowdown in the American economy is not yet in sight.

ZyMOS Provides The Standard Cell Alternative To Gate Array Design.



Analog And Digital

A New Choice. Until now, the semi-custom IC world has been subject to the design limitations of digital gate arrays.

ZyMOS has changed all that.

We've developed libraries of standard cells that provide exactly what you want and need: analog and digital functions. Now, you can deal with real-world analog information like temperature, pressure and voice recognition.

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Which means the limitations of designing with gate arrays vanish. Parts count goes down. So does overall system cost. And the cost of putting it all together. Suddenly, you're left with a smaller system that does more than ever before.

A lot more.

In fact, customers have used our analog libraries to develop a variety of innovative devices. Like floppy disk head controllers. Energy management systems. Even jackhammer motor controllers.

The Largest Libraries. We have something no other standard cell company has: the industry's largest libraries of analog and digital cells. Which gives you unmatched performance. And flexibility. Our analog library includes:

- analog-to-digital converters
- digital-to-analog converters
- single or dual-supply op amps
- comparators
- matched resistors, capacitors and transistors
- a wide range of multiplexers and analog switches
- VCOs and Schmitt triggers

The comprehensive digital libraries offer a variety of fully characterized functions optimized for maximum performance. We've even added programmable logic arrays (PLAs), RAM and ROM—with compilers—plus Intel's 80C49 microcontroller. These analog and digital libraries are available on your CAE workstation, Prime or VAX™ minicomputer, or remotely from your facility.

Our five years of experience makes your task easy. And our training classes help you get started and up to speed fast. We'll even help with your design.

Our Working Silicon Guarantee. We guarantee your circuit will function. In silicon. The first time. If you're interested in learning more, send a schematic of the device you're designing for a quote. Discover how easy and cost effective standard-cell design can be.

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Circle 49 on reader service card

THE PRICE OF EXCHANGING TECHNOLOGY WITH JAPAN

A Defense Science Board panel insists that "it would be in the overall best interest of the U.S. to increase technological cooperation in defense with Japan if it can be achieved on a truly bilateral basis." That proposal by the DSB panel headed by Hughes Aircraft Co.'s executive vice president Malcolm Currie is bound to bring strong responses—for and against—from both the U.S. military services and their contractors.

The DSB, made up of industry and academic leaders, is not dodging the issue or the implication that the recommendation carries: Japan has advanced electronic technologies that could be of value in America's defense. The view of DSB's Currie, a former Defense Department research and development chief, and his colleagues is that, first, "Japan's defense industry . . . will grow with or without us," and, second, a two-way technology flow must replace the current one-way system where Japan acquires weapons and technology from the U.S.

The technology areas where Currie's group believes the U.S. can benefit most from an exchange are high-speed integrated circuits using gallium arsenide, ceramics and composite materials, and production technologies using robotics.

Leaders in America's weapons industries see distinct benefits from reciprocity in the short term. For the longer term, however, Japan's weapons suppliers see distinct benefits from being able to carve themselves a share of the world's weapons business. After all, the U.S. has budgeted more than $9.57 billion in fiscal 1985 alone for various security assistance programs, with more than $3.1 billion of that earmarked for American producers' foreign military sales.

U.S. producers feel their contribution to a positive American trade balance will definitely be threatened if Japan becomes a major factor in the foreign market. Japan's political influence in the Pacific region is now greater than at any time since the beginning of the century, and it is spreading to other regions such as Latin America and the Middle East. Both regions are deemed to be critical to the maintenance of a positive foreign military spending balance by the U.S.

A second troubling prospect for the longer term is contained in indications that Japan is moving gradually toward rearming itself, reacting both to demands by Secretary of Defense Caspar W. Weinberger and other U.S. leaders, and to an increased feeling among younger Japanese political leaders that their country should no longer count on the U.S. for protection against their Chinese and Soviet neighbors. Any of these new leaders who are under the age of 45 have no meaningful recollection of nuclear war and its devastation of Hiroshima and Nagasaki. They identify only with Japan's more recent industrial successes, according to most reports.

Those successes continue to strain U.S. relations with Japan. Washington, for example, has a distinct cadre of "Jap bashers" who are persistent in their calls for an increasingly larger share of Japan's home market for U.S. products or, alternatively, sharply increased tariffs on imports into this country from Japan.

Those strains alone are going to make it difficult for the DSB's proposal to gain acceptance in either country. Nevertheless, the Currie report and its recommendations are worth pursuing as a means of diminishing strains and paving a path toward eliminating some of them.

–Ray Connolly

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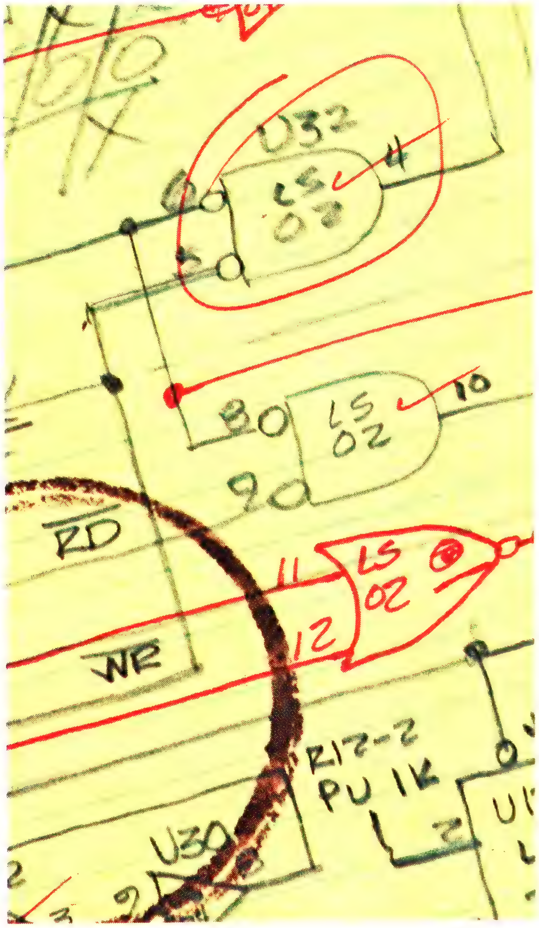

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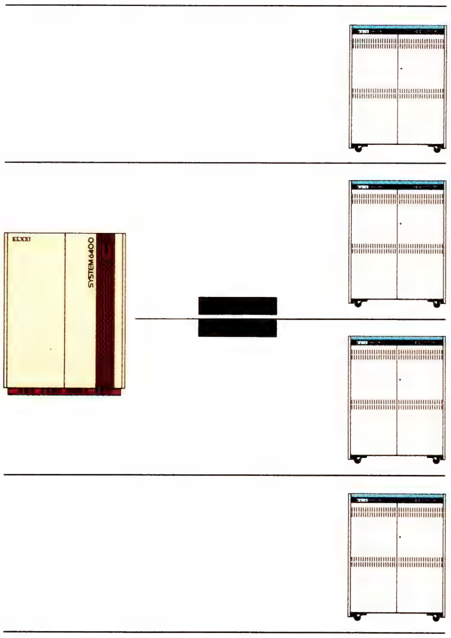

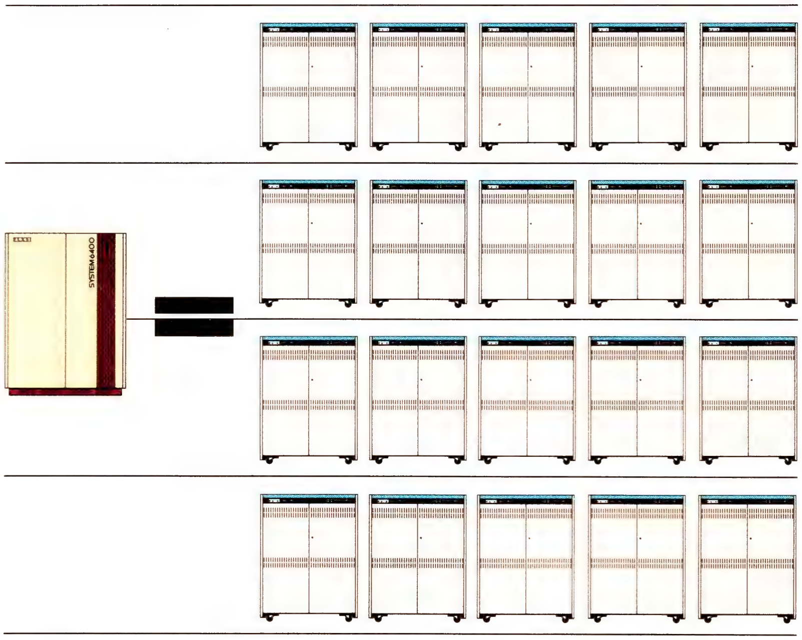

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CHANG REPOSITIONING GI FOR SATELLITE, CABLE TV

New York

Since moving to General Instrument Corp. from Texas Instruments Inc., Dallas, last February, C. Morris Chang says he has been busy thoroughly acquainting himself with the communication systems and computer-related products firm. "I've been spending the last six months getting to know the people and the business," explains General Instruments' new president and chief operating officer.

Chang says the major difference between General Instruments and TI, where he spent 25 years, is his new firm's large cable-television businesses. A major problem he must deal with is that the company registered large revenue and earning declines in its cable business last year, caused primarily by delays in customers' capital programs and more aggressive price competition.

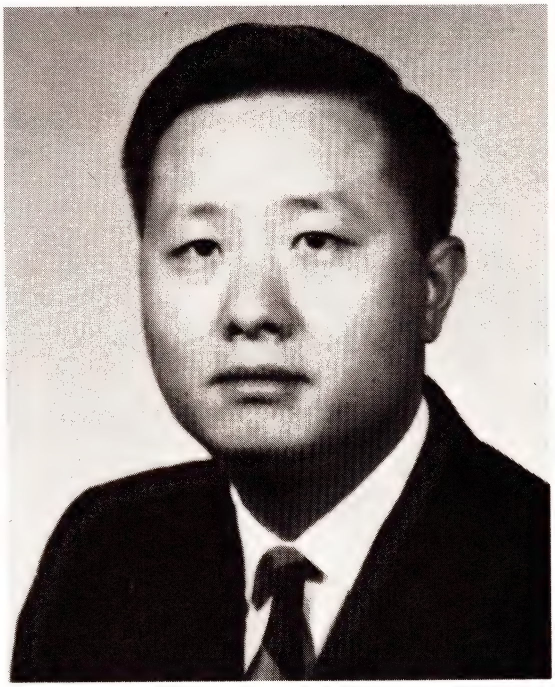
In addition, GI is a majority owner of United Satellite Communications Inc.; this firm and Satellite Television Corp. are the two primary companies remaining in the shaky direct-broadcast satellite industry that recently saw key companies such as RCA Corp. and Western Union Corp. drop out. "Eventually, DBS will be an important market," perhaps in the next two to three years, Chang asserts. "We're going to continue to work at it."

At TI, Chang headed a company-wide quality-reliablity assurance program involving its end-equipment divisions [*Electronics*, Mar. 24, 1981, p. 95] that "started a movement with TI to make quality a byword," Chang recalls. Furthermore, he sought to instill the philosophy that quality was profitable. "Basically, the same philosophy would apply at GI, he says."

Besides its cable-TV businesses, General Instrument experienced difficulty during fiscal 1984 with the microelectronics end of its semiconductor business, a segment that accounted for one third of its fiscal 1984 revenues. The cause, the company says, was a dramatic decline in demand for integrated circuits for video games and home computers—a market in which GI had been a leading supplier. The collapse of the read-only-memory market at the end of 1982 was the culprit, Chang says, making fiscal 1983 a transition year for the company.

Conversion to silicon-gate technology will let GI ship 256-K ROMs and 1-megabit ROMs this year. Further, Chang says he wants to develop electrically erasable programmable ROM and EPROM products and to expand the firm's rectifier business.

Chang's background is closely tied to the evolution of semiconductor technology, and so his prediction of continued growth in that market over the next decade carries some weight.



Taking a chance. General Instrument's new president and CEO, C. Morris Chang, foresees profits from TV broadcast areas abandoned by other firms.

With an office overlooking Central Park, Chang has come a long way since fleeing Shanghai in 1948 and arriving in the U.S. from Hong Kong the following year.

He holds a BA and MA in mechanical engineering from the Massachusetts Institute of Technology, and did a stint at Sylvania, Woburn, Mass., before going to TI in 1958. Eventually, he became chief troubleshooter as well as a senior vice president. He received a PhD in electrical engineering from Stanford University in 1964. **–George Leopold**

Borrel plays chess with Motorola's European product manufacturing

Geneva, Switzerland

André Borrel is not about to rest on his laurels. As director of the highly autonomous European Semiconductor Division of Motorola Inc., Borrel led what was easily the most successful components operation in Europe during the recession that ended last year. With the division basking in a strong market, Borrel is getting his house into even better order to prepare to confront future markets.

What he has in the works is more than a mere cosmetic change. By the end of this year, Borrel will have redistributed operations in the division's three production centers in

Slick move. By streamlining Motorola's European Semiconductor Division, André Borrel is aiming for a more coherent production operation.

East Kilbride (Scotland), Toulouse (France), and Munich (West Germany) in a way that shuns the standard breakdown for one based on the products each turns out. "This is a level of change that will be far from simple, because it requires a lot of gymnastics in the redeployment of these activities and the people that go with them," he says.

Until now, Motorola's digital bipolar products have been produced in Munich and its linear bipolar products in Toulouse, while East Kilbride has been responsible for all MOS production. Under Borrel's plan, Munich will have product responsibility for digital MOS and gate arrays, and Toulouse will add consumer and telecommunications MOS to its portfolio. The East Kilbride plant's wafer fabrication will be beefed up with a new 6-in. wafer facility that will make it an important center in the corporation's MOS memory strategy.

Borrel, a graduate of the French Ecole Nationale des Télécommunications, joined Motorola's Phoenix Division as a product marketing engineer in 1967. He held a number of marketing posts with Motorola SA in Toulouse before becoming president of the French subsidiary and subsequently assuming his present post. **–Robert T. Gallagher**

Tamura to take NMB Semiconductor from scratch to production in nine months

Tokyo

Takumi Tamura, 66, decided to "do what I want to do during the 6 or 7 years left for me to work energetically." This has resulted in Tamura being named president of NMB Semiconductor Ltd., whose first product will be a 256-K complementary-MOS dynamic random-access memory chip. By next March, he expects the newly formed subsidiary of Minebea Co. to start production under license from Inmos Corp., Colorado Springs, with a staff of only 45 persons, including three production engineers.

Tamura's goals meshed nicely with those of Takami Takahashi, president of Minebea, a multinational conglomerate that produces precision mechanical and electronic components, among them IBM PC keyboards. The two men had dealings before and developed a rapport built on mutual business acumen. Takahashi wanted to add a high-tech subsidiary to his firm.

When Minebea first spoke with Tamura, it was merely to sound out his opinion on the firm's plans to ease its way into semiconductor production with hybrid devices or gate arrays. Mineba's strategy was that these devices would not only be a means of diversification, but that they could also be used by its other subsidiaries.

Tamura advised strongly against this strategy and predicted a disastrous outcome. When pressed further for a formula for success, Tamura said that he would "do what other people don't do, and start with the most difficult device for which there is high demand."

Tamura's advice was accepted and he soon had a new job—piloting the start-up of the Minebea subsidiary. His speed at organizing the new venture can be gauged from the fact that he purchased land for the company's new plant on June 22, little more than two months after he left Tokyo Sanyo Electric Co., where he was general manager, technical operations headquarters.

In between, Tamura helped set up the new firm, found a source of technology, and started placing orders for machinery—which he says will be suitable for next-generation 1-Mb chips. And it looks as if his schedule will remain hectic because Tamura is committed to start production nine months after land purchase.

Tamura says that initial marketing and product evaluation will not be a problem, because the first half-million parts produced each month will be shipped to Inmos. After that, Inmos gets half of production, up to 5 million parts per month, plus a royalty. Availability of the parts from Japan should save Inmos the need to invest in its own production facilities. Moreover, NMB Semiconductor will cooperate in the development of next-generation products.

"If we were to start from scratch, we would need 150 to 200 engineers, and we would miss the market," says Tamura. "But production is a facilities business where a small number of engineers backed by stable management can achieve economies of scale and high yield."

Tamura does not foresee a proliferation of products from his company anytime soon, because it would require the addition of staff and facilities. "We will only make products for which our facilities are suitable," he says. **–Charles L. Cohen**

Fast start. Takumi Tamura is capping a distinguished career with a start-up producer of advanced devices.

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The VAXstation 100 workstation terminal: graphics processor, monitor, keyboard and mouse.

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To be sure, the VAXstation 100 workstation terminal will be the envy of every technical professional who now sits before a computer dedicated to doing one or two things well at the expense of doing anything else.

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The VAXstation 100 workstation terminal mirrors the latest trends in desktop computing with a complete assortment of end-user niceties. They include all-English commands, helpful pop-up menus, descriptive icons and convenient pointing devices.

Powerful screen management software presents the user with an endless array of overlapping applications windows and the means to move easily between them.

With this friendly interface you can simultaneously display and interrelate any combination of tasks. You can work with equal facility in words, numbers, or pictures. You can work concurrently on parts of different jobs. Or on different parts of the same job.

Each application window remains active whether on display or not. Like papers on a desk, windows can be moved at will, allowing you to always maintain a "clean" working environment.

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The VAXstation 100 workstation terminal can be added to any existing UNIBUS™ VAX computer, from the 11/725 to the 11/785.

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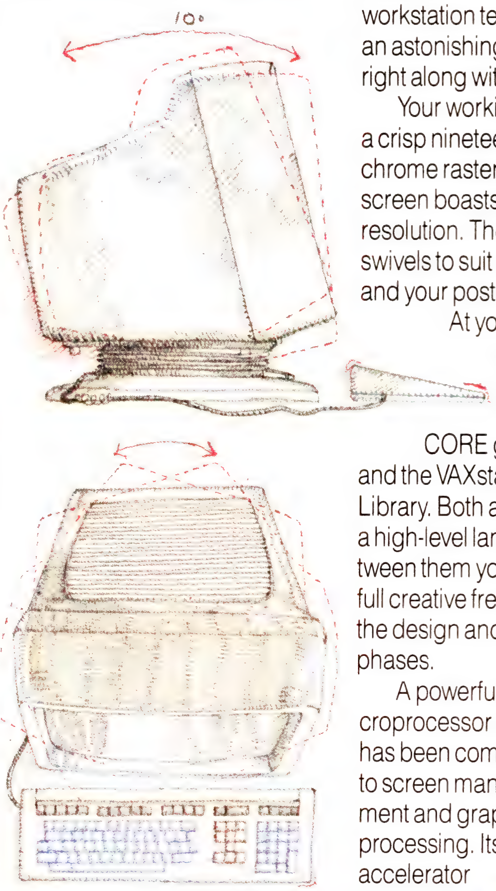
While scaled-down subsystems compromise the performance of micro-based workstations, the VAXstation 100 presents no such barriers. With virtual memory management, your program size is defined by the virtual address space of the VAX computer – some two billion bytes. You also get the complete set of VMS operating system facilities and utilities that have made it a world-famous development environment.



Plus, there's a wide choice of high-level languages important to technical professionals, including industry-standard versions of FORTRAN and Pascal and artificial intelligence languages like VAX LISP.

No matter what you're working on, or how demanding your project is, the VAXstation 100 workstation terminal possesses an astonishing capacity to work right along with you.

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At your disposal is both the CORE Graphics Library (based on the CORE graphics standard) and the VAXstation Subroutine Library. Both are callable from a high-level language, and between them you are guaranteed full creative freedom throughout the design and simulation phases.

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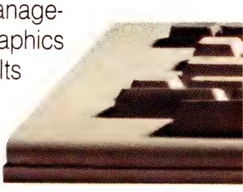

Whether you are working on circuit design, seismographic studies, CAD/CAM, or financial

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modeling, whether you are executing familiar technical tasks or dabbling on the edge of engineering exotica, you'll run out of practically everything before you run out of VAX software.

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VAXstation 100 workstation terminals can be configured with ease. Whether you network them via Ethernet throughout a hierarchy of VAX/VMS systems, or cluster several around a single processor, communications remain streamlined. Each station can access the full range of VAX information management and office automation tools. In this way, the data and programs in general company use can be incorporated into technical projects. Conversely, the highly technical results in a single applications window can be mainstreamed throughout the corporation.

VAXstation 100 workstation terminals let you and your co-workers share and swap information readily. Extrapolate results quickly. Draw conclusions confidently. They rescue the technical professional from tiresome commuting between single-function workstations. They declare war on errors and lost time attributable to manual conversions.

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The first add-on workstation terminal for VAX systems, the VAXstation 100 is also the first in a family of new workstation products from Digital. Each reflects Digital's dedication to providing integrated computing solutions.

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Each VAXstation 100 system comes backed by full Digital service and support from coast to coast and in 44 foreign countries. Each carries with it Digital's enviably high reputation for quality and engineering excellence.

BEST ENGINEERED MEANS ENGINEERED TO A PLAN.

The VAXstation 100 workstation terminal, like every Digital hardware and software product, is engineered to conform to an overall product plan. This means Digital systems work together easily and expand economically. Only Digital provides you with a single, integrated computing strategy direct from desktop to data center.

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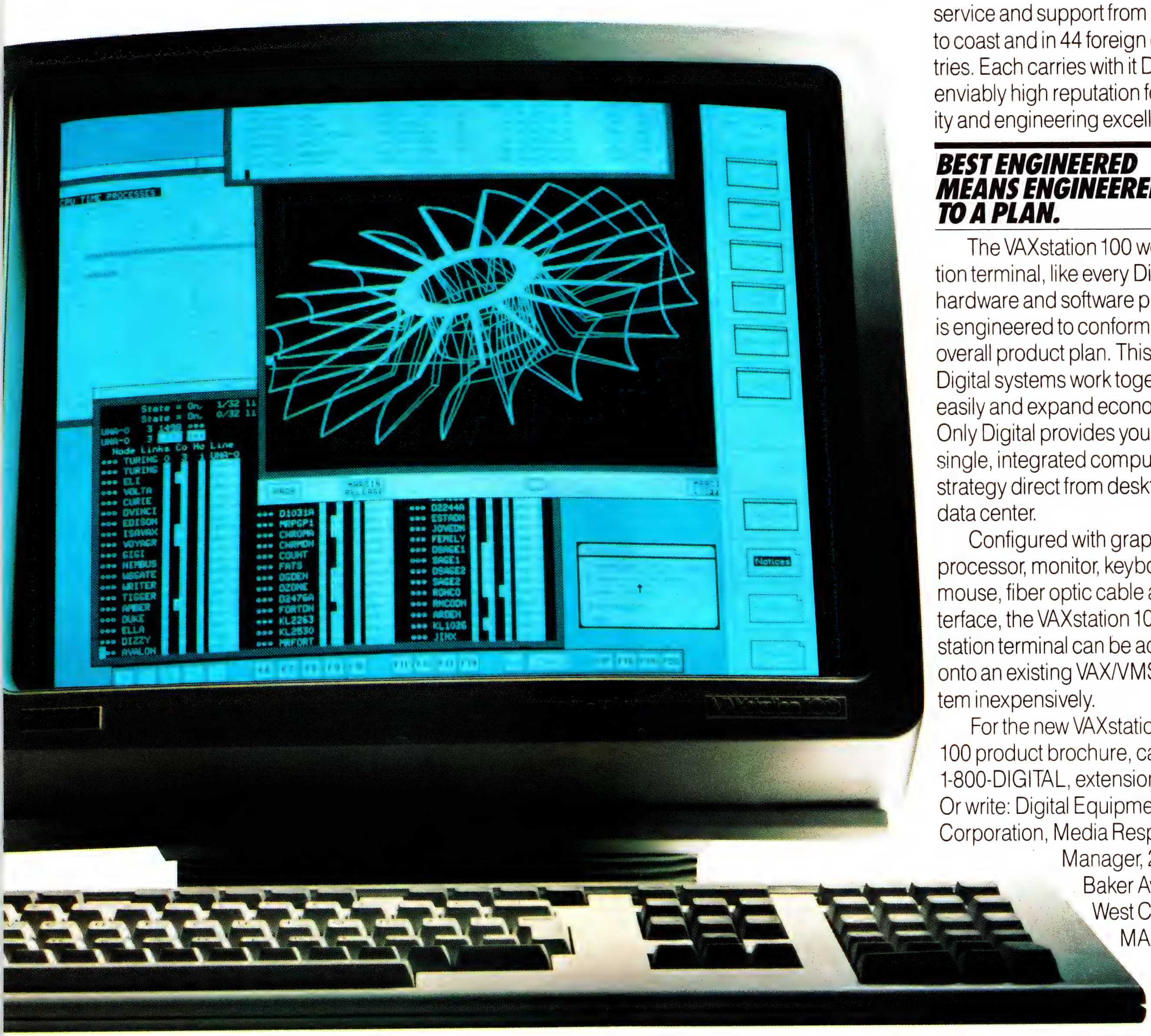
For the new VAXstation 100 product brochure, call 1-800-DIGITAL, extension 250. Or write: Digital Equipment Corporation, Media Response Manager, 200 Baker Avenue, West Concord, MA 01742.



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GENERAL
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NIMBLE NETWORK RESEARCH EXPLOITS MARKET NICHE

Santa Monica, Calif.

Few savvy industry observers will dispute that the business of supplying operating and application software for mini- and microcomputers has moved into the inevitable shakeout period, a polite term for forced company sales and outright failures that will leave only the strongest firms standing. Nevertheless, such is the dynamism of the computer field that it still creates opportunities for the nimble entrepreneur.

Clearly, one of these niches is software for networking—in particular, programs that have vendor interoperability, which means the ability to tie together equipment, operating systems, and protocols from many different vendors. First out of the starting gate with a package of this type that is achieving widening recognition was the small but rapidly expanding two-year-old Network Research Corp.

Introduced in 1983 under the name of Fusion, the package's appeal centers on its many networking capabilities. It can, for example, provide file transfer and virtual terminal operation between an IBM Corp. Personal Computer running on a PC-DOS operating system, any 68000-based work station with the Unix operating system, and a Digital Equipment Corp. VAX computer with the VMS operating system. Other combinations of processors, operating systems, and local-network protocols are possible.

Borrowed capital. Interconnecting the proliferating base of microcomputers with existing larger machines, in fact, was the goal of founder Howard R. Gordon when he started the firm with a $6,500 loan. "It was clear that the value of micros was limited by an inability to support minis and completely share the resources of any remote system," he explains.

Moreover, he continues, even though networking software was seen as the medium of choice to exploit data communications, very little of it existed, other than proprietary programs or limited, low-performance lines. "Everyone was talking about it, customers demanded it, yet everyone underestimated its difficulty," he recalls. "Nothing spanned the entire population."

Standing tall. Exploiting the vendor-interoperability niche in the software market has proven profitable for Howard Gordon (standing), president of Network Research Corp.

Gordon and a small group struggled to bring out the initial version of Fusion, which worked at first only on DEC computers. While a standard package was not then envisioned, the market feedback on the need for vendor interoperability soon headed Fusion on that track, and the fledgling firm started adding features, a process that continues.

In the current version, the package links five processors (VAX, PDP-11, 68000, 8086, and 8088) and can be adapted to any other processor that has an Ethernet controller and C-language compiler. Besides the Unix, VMS and PC-DOS operating systems, it can run on any system with a C compiler without modification. It handles networking hardware from such firms as 3COM, Interlan, Excelan, and Communication Machinery, and protocols from either Xerox Corp.'s XNS internet transport or the ArpaNet TCP/IP.

The way the networking software market itself has unfolded makes it tough to agree on its overall size. The 1984 market is estimated at about $200 million, but this includes proprietary products. Still, the entire field is growing at a projected 45% annual rate. Gordon says his 1984 sales will be about $3.5 million, with $10 million the goal for 1985.

He notes that in his firm's short existence, the perception of the customer mix has undergone considerable revision. In the beginning, he foresaw the user as the main buyer, but original-equipment manufacturers have come on so strong that they now represent 80% of the total.

Eetwork Research has signed up a roster of equipment builders who are licensing Fusion, and more are coming on board each month. Present licensees include NCR, Motorola's Four-Phase computer unit, Control Data, Mosaic, and Calcomp, along with system integrators.

Knowledge of Network Research and Fusion so far is somewhat limited, even in the tightly-knit software community, but that is beginning to change. For example, consultant Harvey Freeman of Architecture Technology Corp., Minneapolis, says the package is "starting to make noise," and his clients are picking up on it. He cautions, however, that adding capabilities to existing packages is not as easy as it sounds. "It's one thing to say it, quite another to do it, as many big firms found out."

Also, there is the matter of competition fast entering the field of vendor interoperable software. "There's no question about it, they're coming," notes Craig Burton, of Norvell Inc., Orem, Utah, which supports some 13 different local-network configurations.

As for the future, Network Research will add new processors and capabilities to Fusion, a process which will take less time as his firm gets more experience at it, Gordon says. An advanced Fusion package is due out later this year, with better speed and efficiency. **–Larry Waller**

Keene stitches disparate pieces into a profitable, busy quilt

New York

Far from the bright lights shining on more glamorous electronic markets, Keene Corp. is quietly piecing together a concern that thrives on such products as high-temperature laminates for printed-circuit boards, anechoic chambers, and fiber-optic communications systems for rooms that must be secure.

Founded in 1967, Keene is a subsidiary of Bairnco Corp., a diversified manufacturer of lighting, industrial, and electronic products. Keene's founder, Glenn Bailey, formed Bairnco as a holding company to incubate up-and-coming business operations and then spin them off at maturity.

In explaining his firm's business philosophy, Keene president Eugene Cafiero notes that "we look for companies that have come up with a unique solution to a problem—ones that are just becoming successful. We step in and capitalize on it." (Cafiero is no stranger to corporate management, having served as president and chief operating officer of Chrysler Corp. from 1975 to 1978.)

"They get into specialty niches that offer exciting growth," says Stanley Lanzet, first vice president of research at Drexel Burnham Lambert Inc., New York. "It's a very interesting and unique concept that seems to be working," observes Jonathan Progoff, a research analyst with E.F. Hutton, New York.

SRS Industries, a recently acquired Monrovia, Calif., firm, exemplifies the type of operation that Keene craves. SRS makes enclosures for the control of electromagnetic energy and for the aerospace, defense, and electronics industries, as well as gaskets used for electromagnetic-interference shielding in aircraft and computers.

"We think SRS can grow at a rate of 800% in just a few years," maintains Arnold Zais, who retained his post as president of a firm called Ray Proof when it was acquired in 1973 and later became president of Keene's Shielding Group.

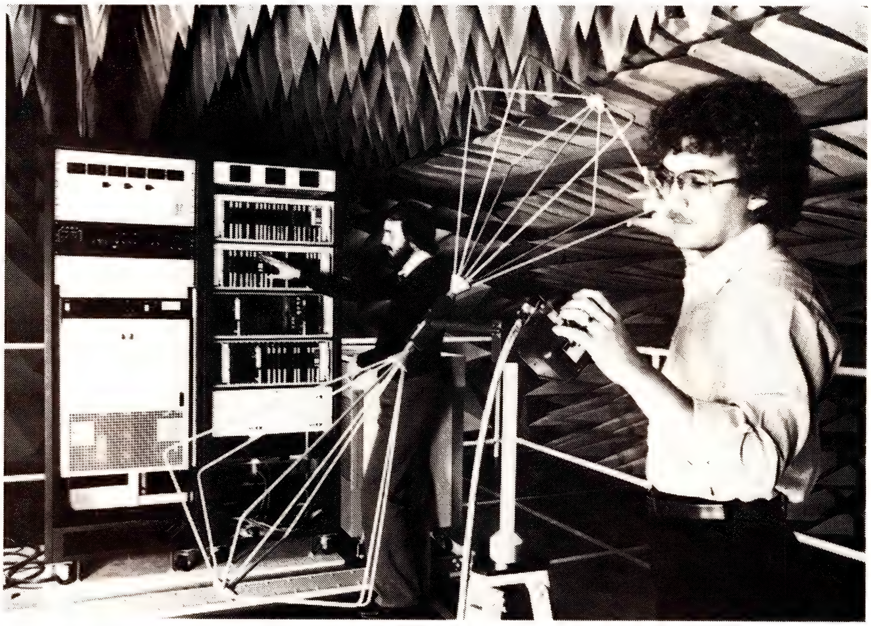
Built with absorber materials that are also made by the Shielding Group, Keene's anechoic chambers carry a price tag of about $1 million. In November of 1983, the firm completed the first chamber to be certified by the Federal Communications Commission, a type of room purchased by such companies as IBM Corp. and Digital Equipment Corp. to test computers for compliance with FCC regulations for electromagnetic interference.

Another operation within the family fold is Versitron Inc., Washington, D.C., which was acquired in March 1984. It makes a variety of products including the fiber-optic modems, links, and multiplexers now used in government high-security shielded rooms, which are impervious to emi and contain confidential signals. When fiber-optic systems become more common, "We'll exploit them commercially," says Zais.

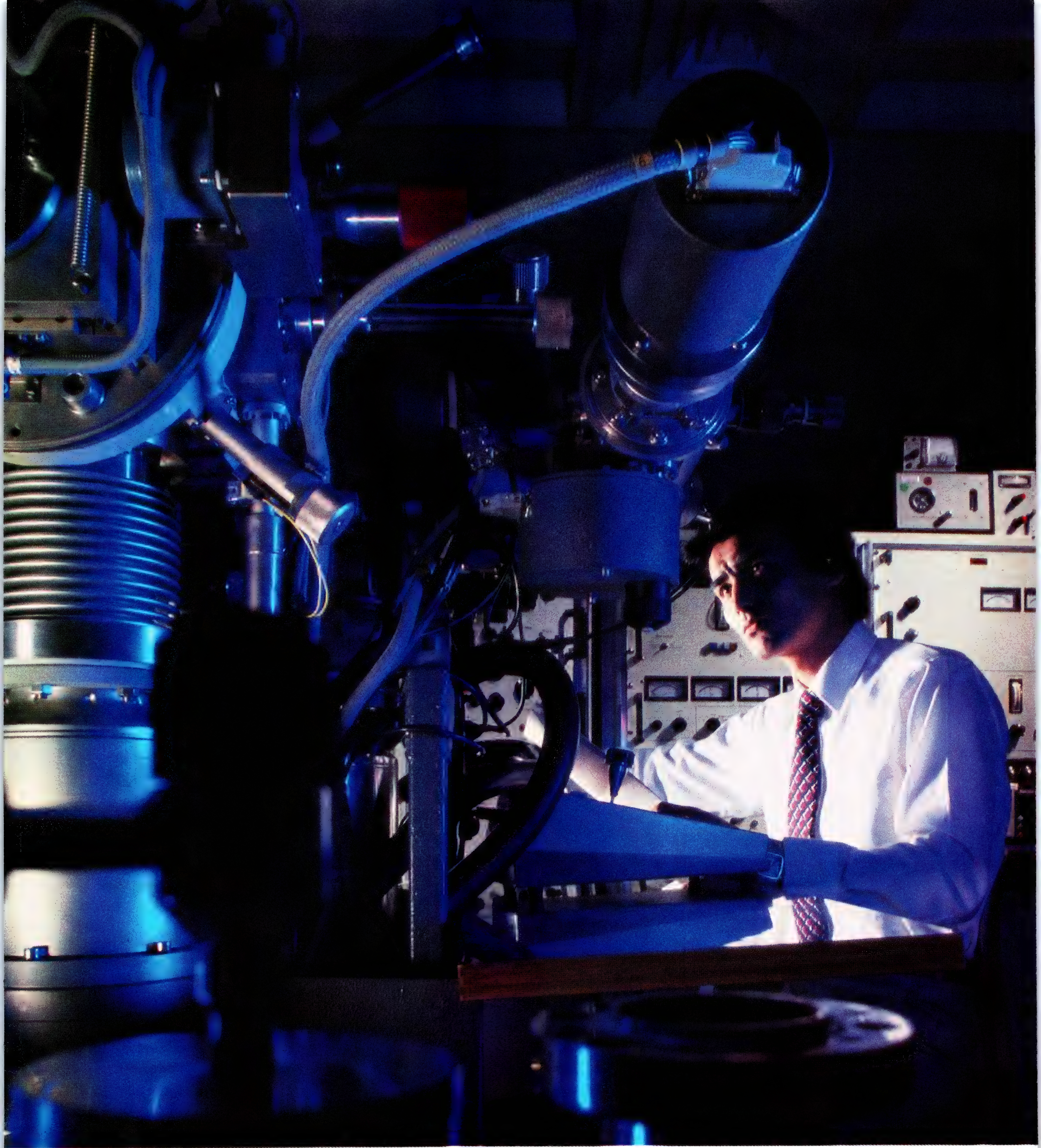
Still another operation is Howe Industries, Van Nuys, Calif., a manufacturer of laminates that have a high dimensional stability and are used in multilayer pc boards for aerospace applications. It also supplies flexible materials for printed circuitry in automotive panels. Howe, whose sales have tripled since July 1983 when it was acquired, will soon finish a 74,000-ft^2 building in Cucomonga, Calif.

All this has proved profitable for Bairnco and for Keene, which accounts for 25% to 30% of the parent's sales. For the first half of 1984, Bairnco's sales rose to $245.3 million from $163.8 million in the first half of 1983, while its income from continuing operations jumped to $12.0 million from $7.7 million a year ago.

Keene's operating profit on composites and shielding, which include its electronics operations, totaled close to $8 million for the first six months of 1984, a hike of 161%. Sales rose proportionately, and Keene believes the momentum will continue. In the next few years, says Cafiero, "I would be disappointed if we didn't double again [in electronics operations]." **–Steve Haggerty**



Looking good. The market for shielded chambers, which cost about $1 million each, is one of the many niches in which Keene Corp. participates through its subsidiaries.

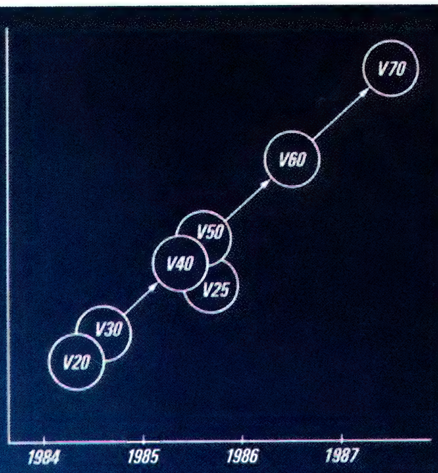


PACE QUICKENS IN JAPANESE ELECTRONICS INDUSTRIES

Semiconductors/67 Optoelectronics/83 Computers/89
Communications/100 Test & Measurement/105

SPECIAL ADVERTISING SECTION

V is for V-Series, your invitation to evolve.



Vroom into the VLSI era with NEC's new family of 16/32-bit CMOS microprocessors.

NEC invites you to discover the V-Series: a superior species of CMOS microprocessors. Making your software run farther and faster, they slip into most existing systems and produce immediate performance gains.

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The V20/V30 are supported by a clan of CMOS peripherals. A CMOS coprocessor (Floating Point Processor) is under development, and a proprietary Real Time OS is part of the package. Development tools include an In-Circuit Emulator, Relocatable Assembler, Pascal and C compilers. And NEC has already loaded the pipeline with powerful support tools soon to come. The V-Series is second-sourced by Zilog, Inc.

V40/V50/V25: SYSTEMS ON A CHIP.

Next year, the peripherals hop on board. The V40 and V50 feature peripheral functions integrated on V20 and V30 silicon. The V25, complete with ROM, RAM, I/O port and serial interface, is a powerful processor for portable products. The V20–V50 give you turbocharged performance while capitalizing on current software developed for our NMOS micros.

V60/V70: MICROELECTRONIC MAINFRAMES.

32-bit microprocessors with mainframe power, the V60 and V70 will be waiting when you're ready to move up to 32-bit μP-based products. Features include an on-chip Memory Management Unit and a 4.3-gigabyte virtual memory.

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Behind the V-Series is a company with a VLSI vision.

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NEC
NEC Corporation
Tokyo, Japan

DYNAMIC EXPANSION CONTINUES IN JAPAN'S ELECTRONICS INDUSTRIES

No doubt about it, business is good in Japan's high-technology industries, one key reason being the ever-quickening pace of electronics research and development that is coming to fruition in new products. An example is teleconferencing, as shown in this Fujitsu photograph.

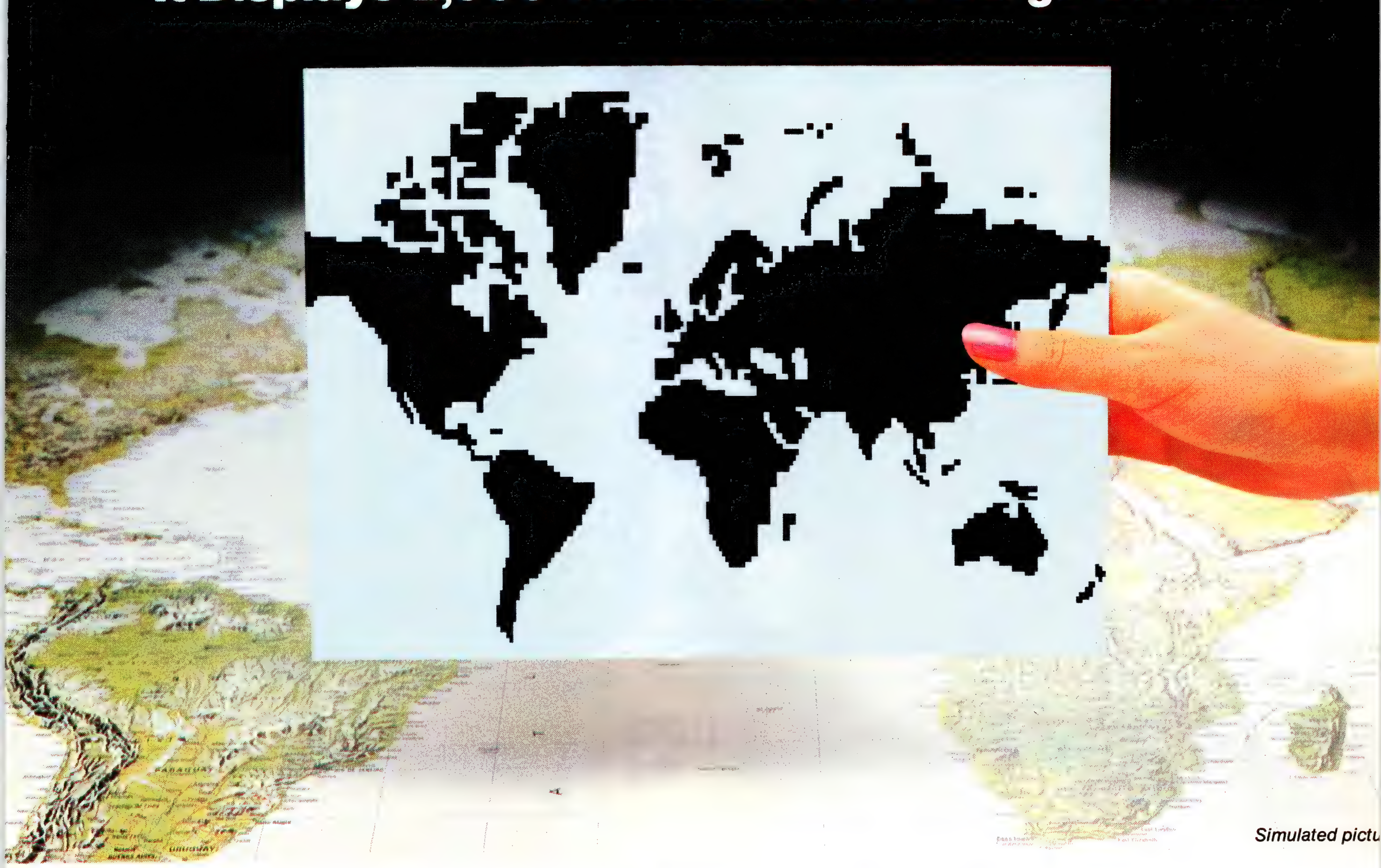
For such achievements, advances are necessary in a wide range of electronics fields—and they are occurring in Japan. In semiconductors, shrinking feature sizes and large wafers are making new demands on the makers of production equipment. Another important trend is the increasing capabilities of the domestic equipment makers.

The young industry of optoelectronics is experiencing dramatic growth, almost all of it stemming from the interest in using optical communications for both data and voice. One important factor in the growth of the Japanese computer industry is the spread of personal computers, and they in turn are one reason that the telecommunications industry is preparing for a digital future. As all of these fields grow, moreover, the need for new and better test and measurement gear is spurring that industry on.

The following reports on these industries were prepared by staff members of the Industrial Econonomics Department, Nomura Research Institute, working under the direction of Mamoru Kohayakawa. The cover photograph of an ion microprobe analyzer in use is courtesy of NEC Corp.

There's Room in One LCD Module for the Entire Globe.

–It Displays 2,000 Characters on a Large Screen–



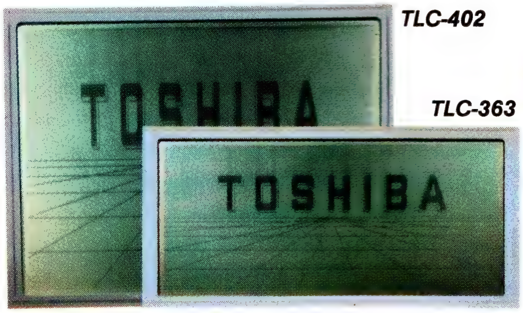
Simulated pictu

New LCD modules from TOSHIBA give you 640 × 200 dot displays plus your choice of display area: virtually the size of an ordinary magazine or half that size.

The large display area puts a lot of information on view – either module can give you an array of 80 characters × 25 lines. Yet TOSHIBA technology cuts bulk and power consumption to the bone. These slim LCD modules are battery-powered, and they are compatible with current CRT displays without changing software.

All these features add up to portability. Versatility. Usability. These LCD modules are ideal as displays for portable word processors, personal computers, POS terminals and other display terminals.

Ask us. TOSHIBA is there when it comes to the technology you need in LCD components.



Specifications

		TLC-402	TLC-363
Display			
Number of Characters		80×25 (2,000 characters)	80×25 (2,000 characters)
Dot Format		8×8, alpha-numeric	8×8, alpha-numeric
Overall Dimensions (W×H×D)		274.8×240.6×15.0 mm	275.0×126.0×15.0 mm
Maximum Ratings			
Storage Temperature		–20 – 70°C	–20 – 70°C
Operating Temperature		0 – 50°C	0 – 50°C
Supply Voltage	V_{DD}	7 V	7 V
	$V_{DD}-V_{EE}$	18 V	18 V
Input Voltage		$0 \leq V_{IN} \leq V_{DD}$	$V_{SS} \leq V_{IN} \leq V_{DD}$
Recommended Operating Conditions			
Supply Voltage	V_{DD}	5 ±0.25 V	5 ±0.25 V
	V_{EE}	–13 V Max.	–13 V Max.
Input Voltage	High	4.0 V Min.	4.0 V Min.
	Low	0.5 V Max.	0.5 V Max.
Typical Characteristics (25°C)			
Response Time	Turn ON	300 ms	300 ms
	Turn OFF	300 ms	300 ms
Contrast Ratio		5	5
Viewing Angle		15 – 35 degrees	15 – 35 degrees

Design and specifications are subject to change without notice.

TOSHIBA

Toshiba America, Inc.: Electronic Components Business Sector, Semiconductor Div.: 2441 Michelle Drive, Tustin, Calif. 92680, U.S.A. Tel. (714) 730-5000
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Circle 65 on reader service card

Sight for Sore Eyes

Hitachi helps you reduce user eye fatigue by producing monochrome and color display tubes that excel in resolution, contrast, brightness and clarity. Tubes that your customers will love at first sight, because they are the result of these human-oriented breakthroughs in CRT technology:

Fine-patterned phosphor screens
We've developed new methods of applying color phosphors to screens in order to increase dot uniformity and reduce dot diameter down to a fine-pitch 0.21 mm for greater definition. That means less blurring of colors, blacker blacks, and higher resolution in graphics and characters.

Reduction of glare
Screen glare is a leading cause of user discomfort, so we came up with special treatments that cut glare to a minimum. Available on models of all sizes, one is our "direct-etching antiglare face." Spray coating and multi-layer coating can also be applied to reduce reflection.

Less flicker, higher contrast
Hitachi offers long-persistence phosphors for both monochrome and color screens to cut down irritating flicker. Numerous phosphor tones allow users to specify their own monochrome display colors; color tubes can be supplied with the traditional R-G-B combination or a new R-G-Light Blue. And lower-transmission glass, ranging from clear to grey to dark tint, can help improve contrast according to your requirements.

We believe people deserve to be pampered, and we've committed our engineering skills to just that. Manufacturing each and every product with the end-user in mind. Supplying you with components that exceed expectations. So give your own eyes a treat. Look up your nearest Hitachi representative for a personal view of our complete CRT line-up.

HITACHI

For more information:

Hitachi, Ltd. Electronic Devices Group, New Marunouchi Bldg., 5-1, Marunouchi 1 chome, Chiyoda-ku, Tokyo 100, Japan, Tel: Tokyo (03) 212-1111, Telex: J22395, J22432, J24491, J26375 (HITACHY), Cable: HITACHY TOKYO **Hitachi America, Ltd.** Chicago Office, 500 Park Boulevard, Suite 805, Itasca, Ill. 60143, Tel: (312) 773-0700, Telex: TWX910 651 3105 (HITACHI ITAS), Fax: (312) 773-1366 San Jose Office, 2099 Gateway Place, Gateway Office Park, Suite 550, Tel: (408) 277-0134 **Hitachi Electronic Components Europe GmbH,** Hans-Pinsel-Str. 10A, 8013 Haar, München, Tel: 089-46140, Telex: 05-22593 (HITEC D) **Hitachi Electronic Components (U.K.) Ltd.,** HITEC House, 221-225 Station Road, Harrow, Middlesex, HA1 2XL, Tel: 01-861-1414, Telex: 926293 (HITEC G)

Circle 66 on reader service card

SEMICONDUCTORS

Rising demand for chips of all types spurs investment, giving new boost to equipment makers

by Shiro Tanikawa

Even as semiconductor consumption in Japan has risen to meet the needs of expanded production of personal computers, video cassette recorders, and various other electronics equipment, demand has intensified on a worldwide basis. Japan's semiconductor production reached a total of 1,560 billion yen in 1983, according to industry statistics. That figure represents an increase of 30.4% over the previous year.

Of this total, production of discrete devices, stimulated by the increase in VCR demand and the recovery of audio equipment, amounted to 472 billion yen, an increase of 16.7% over the previous year. As for integrated circuits, production of digital ICs, including memories and microcomputers, increased by nearly 40%, as was the case in 1982.

Linears Grow Too

Linear IC production, which fell 6% in 1982 owing to the stagnation in the audio market, experienced a rapid recovery, increasing at a rate of 25.8%. IC production as a whole was thus able to register an increase of 36% over the previous year, totalling 1,140 billion yen.

In spite of this expanded production, semiconductor supply has continued to be tight since the latter part of 1983. The big semiconductor manufacturers, most importantly NEC Corp. and Hitachi Ltd., have scheduled large-scale capital investments for this year, and 1984 semiconductor production should break the 2,000 billion yen mark. It is thought, however, that the results of this investment will only be fully manifested in 1985.

Supported by this large-scale capital

CORPORATE STRATEGIES

Tadahiro Sekimoto, president NEC Corp.

The development of electronic and digital technology has brought about the integration of computer and communications technologies while ushering in a new electronics business that has been dubbed "C&C" (computers and communications). Fully equipped with technological and business capabilities in the fields of computers, communications and electronic devices, we will elaborate our basic business strategy through which we will pursue C&C right into the 21st century.

Today in Japan, people talk a lot about "new media," a Japanese term derived from English and standing for new means of communications including satellite communications, cable TV, and videotex. They go beyond any media currently in existence. As a matter of fact, the new media are C&C from the viewpoint of communications.

I would like to speak metaphorically about the new media. Imagine a drama in which the stage setting is the hardware, of which wondrous products can be manufactured. The scenario is the protocols and programs, which are now making remarkable progress.

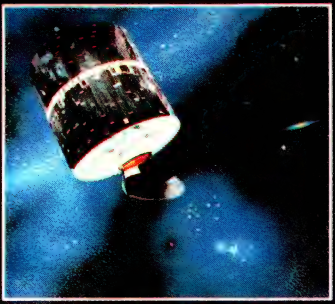
However, the stage setting and the scenario are not enough to attract a wide audience (users of our products) and to maintain a theater company (ourselves as a supplier). There must be actors and actresses and their artistic skills as well. And what produces a great impression on the audience is probably the high-quality performance, which can be regarded as the application software. Because of this, it is applicationware that can vitalize the new media and our C&C business.

In a broad sense, software is the most important factor in a successful drama. In other words, it is a matter of the type and quality of information. And the theater company is required to provide exactly what the audience is seeking while ascertaining the type of information and the degree of quality that are desired.

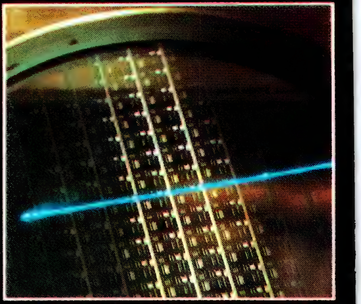
I myself define the information society as a society where the wisdom and ability of mankind are tested. This means that we at NEC must understand that we are also being tested, and we should make all possible efforts to skillfully play our roles in a drama called C&C.

ADVANCED AND EVER ADVANCING **MITSUBISHI ELECTRIC**

Mitsubishi Electric is an industrial giant that straddles the commanding heights of electronic technology. Semiconductors. Communications. Computers. All the key technologies for future generations of intelligent products and systems. And the best guarantee of consistent, long-term corporate growth.

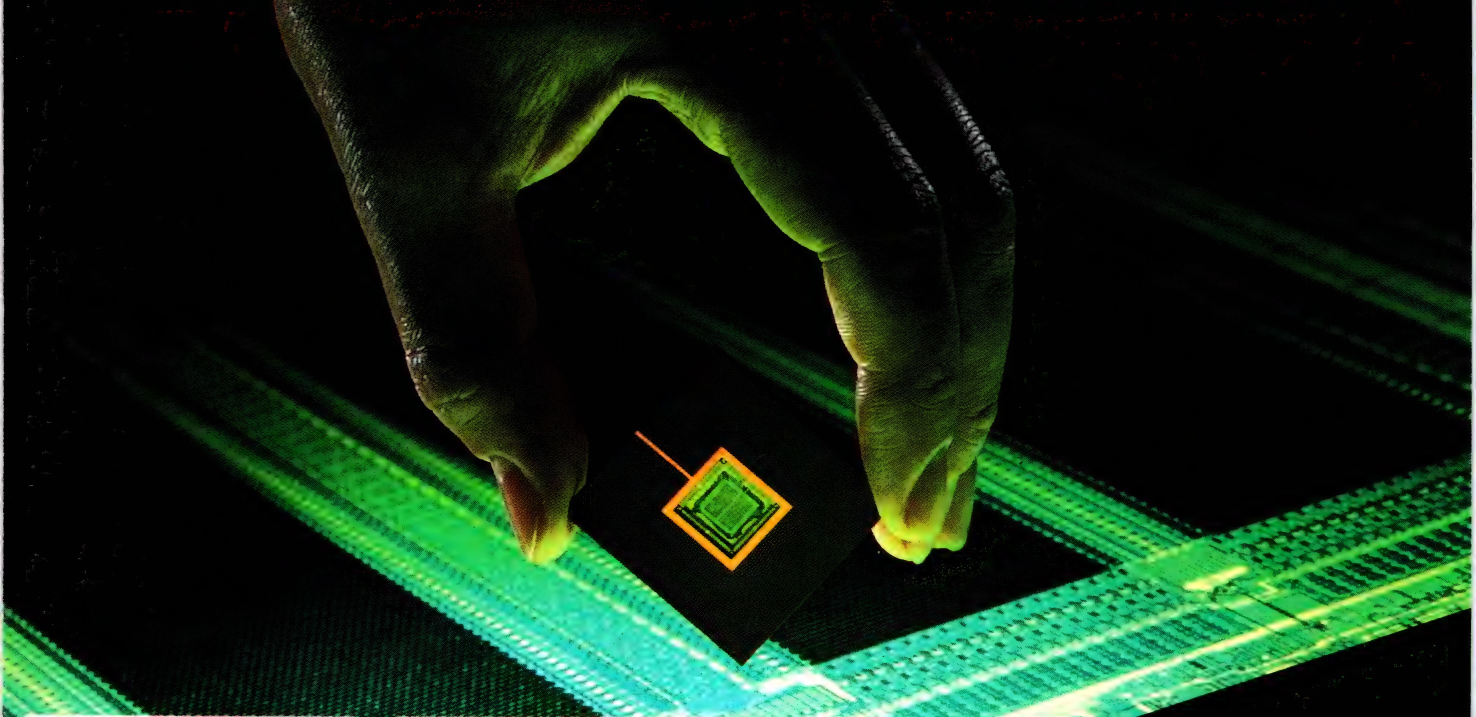


Our technology serves Japan's space effort.



Single crystallization using a laser beam.

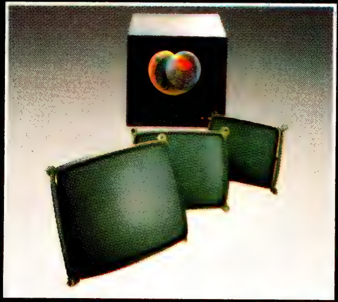
MITSUBISHI ELECTRIC— The Highly Integrated Approach



Mobile telephone.

32-meter satellite communications antenna.

16-bit personal computer.



High-resolution CRTs and display modules.

Our VLSI dynamic RAM is a masterpiece of large-scale integration. And it symbolizes our whole approach. We integrate expertise from a hundred different disciplines to create electronic products and systems that add pleasure and interest to the lives of millions. To ease the tasks of our engineers in anticipating market needs. To cut manufacturing costs and boost quality. And to ensure us a major role in building the information-oriented society of tomorrow.

MITSUBISHI ELECTRIC

Circle 68 on reader service card

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investment, the market for manufacturing equipment has picked up. An especially notable trend in this connnection is the full-scale introduction of 6-inch wafers into production lines for 256-K dynamic random-access memories and other very large-scale integrated circuits.

6-in. Wafers Spread

At the present time, Fujitsu Ltd. is operating a 6-in. pilot line at its Iwate plant and has adopted a full-fledged 6-in. line for its Mie plant scheduled to begin full operation at the close of the year. Various other manufacturers are introducing 6-in. wafers into their plants: NEC in a new production line in its Kyushu plant, Texas Instruments Japan Ltd. into a new line in its Kofu plant, and Toshiba Corp. into a new line in its Oita plant next spring.

It is anticipated that 6-in. lines will be adopted for a succession of new installations scheduled in the coming years, including NEC's Yamaguchi plant, Hitachi's Naka plant, Hitachi's Hokki semiconductor plant, Mitsubishi's Saijo plant, Matsushita's Uozu plant, and Oki's Miyazaki plant.

In addition, Hitachi was to establish a system capable of producing 1 million 256-K DRAMs per month by August. This in turn has stepped up the pace of the above-related activities of the big manufacturers.

Shrinking Design Rules

Although an extremely high rate of growth has been achieved in almost all sectors of the production equipment industry, growth has been particularly great in the area of steppers, high-current ion implanters, ion etching gear, and other such equipment exerting a critical influence upon shrinking design rules.

Accompanying this rise in the scale

CORPORATE STRATEGIES

Sutezo Hato
executive managing director
and group executive
Electronic Devices Group
Hitachi Ltd.

It is my great pleasure to be able to introduce our products and strategies to the readers of *ElectronicsWeek.* The electronic components operations of Hitachi Ltd. are distinguished by the manufacture of a wide variety of products and the company's constant efforts in advanced product development.

We produce a range of MOS and bipolar memories and microprocessor families, full- or semicustom integrated circuits, as well as discrete ICs, such as semiconductor lasers and photodetectors, and a host of picture tubes and liquid-crystal-display modules. Hitachi's unique magnetic bubble memories and MOS image sensors are also part of our product line. All these enjoy the confidence of our clientele, and we believe this is because their price-performance ratio and reliability are highly appreciated by purchasers.

Hitachi is an integrated electronics and electrical manufacturer and is Japan's largest in its field. The company produces more than 20,000 products, ranging from nuclear reactors and industrial plants to mainframe computers, telecommunications equipment, and diverse materials. It undertakes vigorous research and development in each product area. The exent and depth of our operations and the developmental work at our research laboratories provide easy access to vast stores of technological resources, which we can draw on to develop any particular electronic device.

We can also receive frank and consequently valuable feedback from users within the company. Such intergroup cooperation has, in fact, helped us greatly to improve the performance and quality of our electronic components.

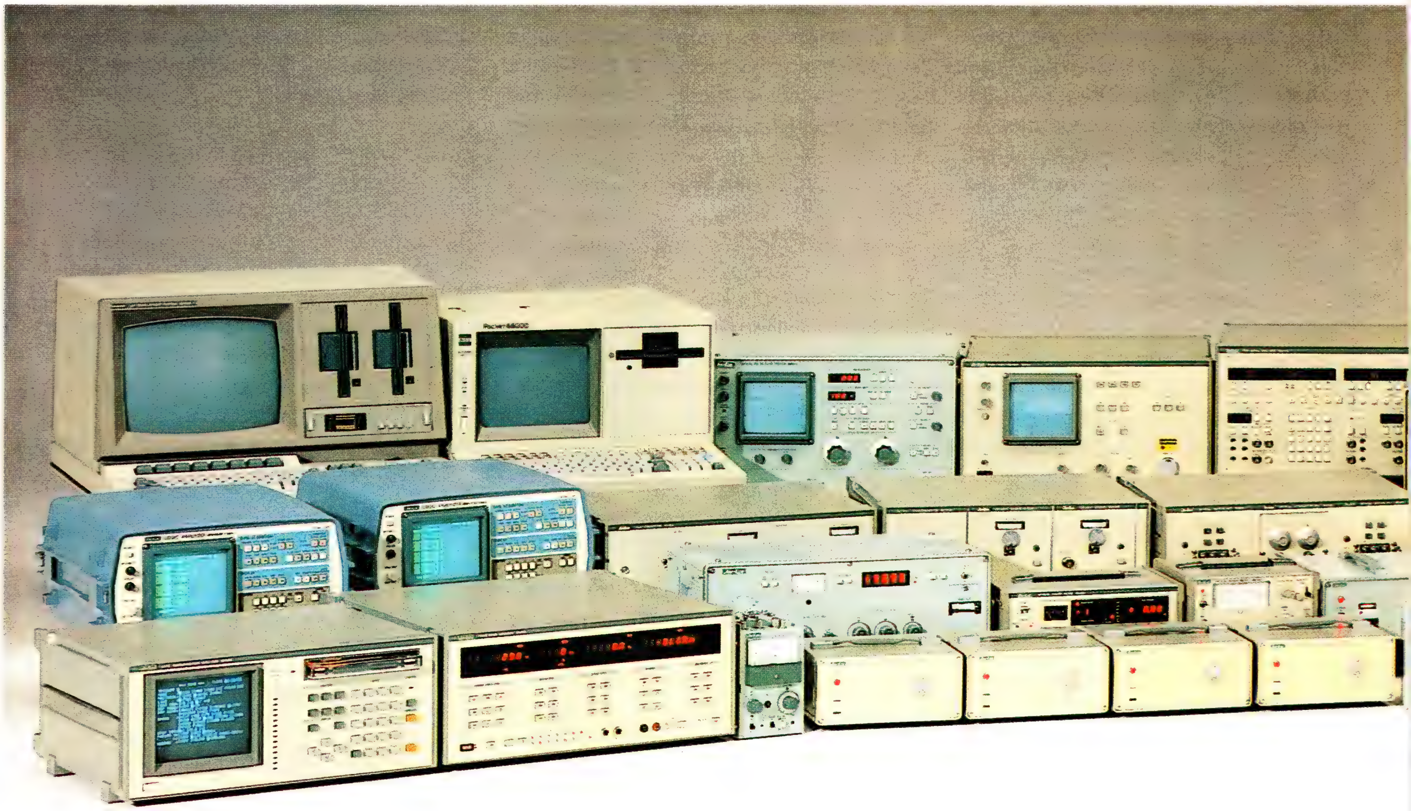
In our IC operation, the 2-μm design rules are now applied to mass-production items, including 256-K dynamic random-access memories, 64-K static RAMs, and 8-bit single-chip microcomputers with an on-chip 16-K-byte read-only memory.

We have long experience in using complementary-MOS technologies for a wide range of products. The solid performance of our large-scale-integration CMOS technology, in particular, has been attested to by the large market share of our 64-K static RAMs. We are confident, therefore, that the introduction of a 1.3-μm CMOS process—the most important focus for our future business—will also prove to be highly successful.

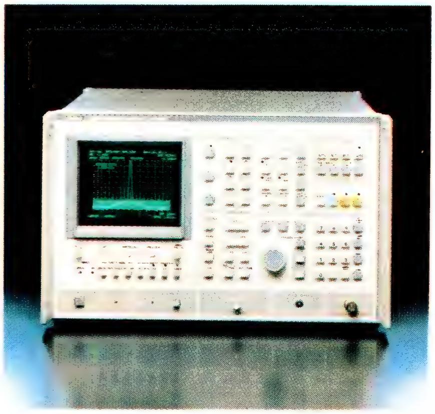
We are making efforts to upgrade our display devices by enhancing the resolution of picture tubes and enlarging the screen size of LCDs. Through such endeavors, we are responding to two distinct trends in microelectronics systems (typically personal computer systems)—one toward higher sophistication, and the other toward greater portability.

Finally, I would like to thank the readers of *ElectronicsWeek* for their guidance and their encouragement, which, we hope, will continue to be forthcoming.

Better Instruments for Better Communications



MS611A Spectrum Analyzer
This analyzer covers the range from 50Hz to 2GHz in a single band, and features auto ranging. Resolution bandwidth is 10Hz to 3MHz too. Another better instrument from Anritsu.



Anritsu means communications.

We began building telephone and radio equipment more than 50 years ago. And although we've expanded into other fields since then, we've remained true to those first electronic roots.

In fact, the Anritsu name is now known around the world as synonymous with communications. From public telephones to sophisticated, state-of-the-art

Circle 71 on reader service card

optical and digital transmission systems, Anritsu communications products are highly regarded for both unequalled reliability and technical excellence.

With such wide-ranging experience in all phases of communications, it's no surprise that our electronic measuring instruments are superior, too.

Anritsu builds the electronic instruments that keep electronic and fiber optic communications operating at the knife edge of efficiency. From the simple measurement of voltage and current to complete high-level analysis of both analog and digital circuitry, Anritsu instruments are built by experts in communications. And Anritsu instruments are built to be used.

Whether it's an Anritsu electronic voltmeter, a network analyzer or a complete GPIB-based automatic test system, you'll find a basic field-proven ruggedness built in. And you'll find controls that actually make sophisticated measurements simpler to perform.

At Anritsu, we're striving toward still better instruments. And better communications.

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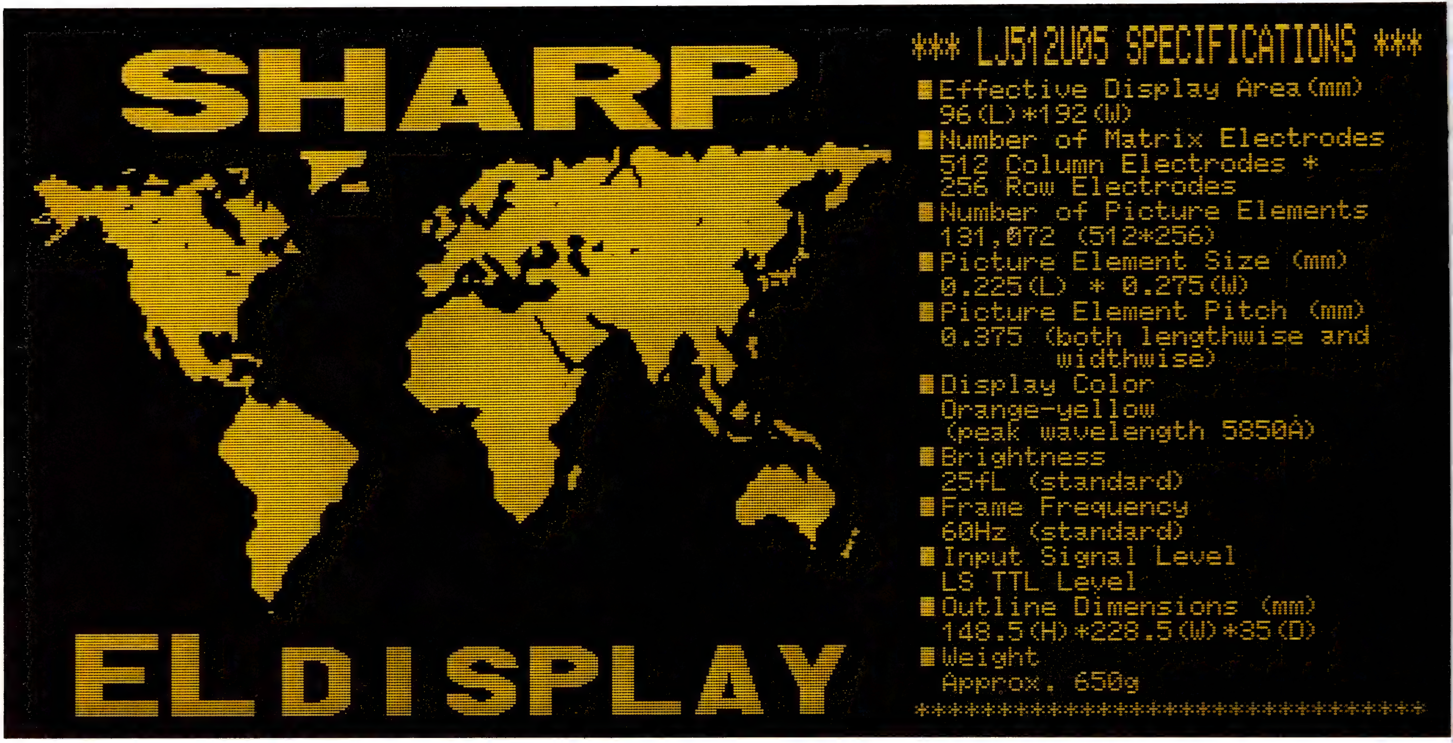
25 LINES OF 80 CHARACTERS!
FLAT PANEL DISPLAYS AVAILABLE NOW!!

This is the actual effective display size of LJ512U05



*** LJ512U05 SPECIFICATIONS ***
- Effective Display Area (mm)
  96 (L) *192 (W)
- Number of Matrix Electrodes
  512 Column Electrodes *
  256 Row Electrodes
- Number of Picture Elements
  131,072 (512*256)
- Picture Element Size (mm)
  0.225 (L) * 0.275 (W)
- Picture Element Pitch (mm)
  0.375 (both lengthwise and widthwise)
- Display Color
  Orange-yellow
  (peak wavelength 5850Å)
- Brightness
  25fL (standard)
- Frame Frequency
  60Hz (standard)
- Input Signal Level
  LS TTL Level
- Outline Dimensions (mm)
  148.5 (H) *228.5 (W) *35 (D)
- Weight
  Approx. 650g

****

Sharp's full line of EL (Electro Luminescent) Displays are thin (34mm), lightweight (650 grams), low power (15 watts max) and the two latest editions can display 25 lines of 80 characters. These "State of The Art" Displays feature; line by line scrolling, blinking characters, full graphics and a simple 4 line interface. EL's bright, crisp, easy to read characters will enhance the marketability of any product.

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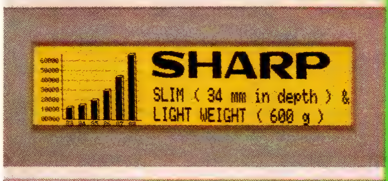
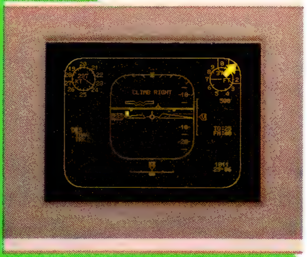
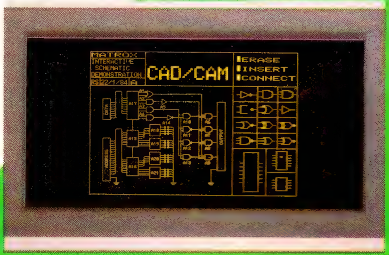


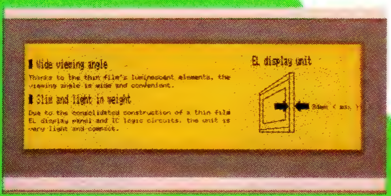
LJ 320U01 • Ideal for fine graphics as well as written characters • Effective display area: 90mm × 120mm • Number of picture elements: 320 × 240 • Outline Dimensions (mm): 148.5(H) × 178.5(W) × 34(D)



LJ 512U05 • Ideal for fine graphics as well as written characters • Effective display area: 96mm × 192mm • Number of picture elements: 512 × 256 • Outline Dimensions (mm): 148.5(H) × 228.5(W) × 34(D)



LJ 640U01 • Ideal for written characters • Effective display area: 60mm × 192mm • Number of picture elements: 640 × 200 • Outline Dimensions (mm): 108.5(H) × 228.5(W) × 34(D)



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Electronic Components Dept.

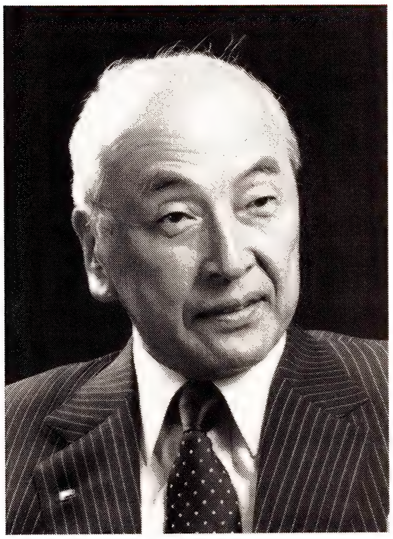
of the equipment market in recent years, four trends can be discerned within Japan's semiconductor manufacturing equipment industry. They are:

- Improvement in the technological capabilities of the equipment manufacturers.
- A decline in the level of dependence upon imports and changes in the structure of semiconductor equipment industry.
- Intensification of overseas activities on the part of domestic manufacturers.
- An increased number of companies in the field.

Through activities undertaken in cooperation with the big semiconductor manufacturers, the equipment manufacturers have upgraded their technological capabilities. This improvement became particularly conspicuous subsequent to the 1976-80 VLSI development project guided by the Ministry of International Trade and Industry.

Along with the improvement in the technological capabilities of domestic

CORPORATE STRATEGIES



Shoichi Saba, president Toshiba Corp.

At Toshiba, we realize the technological innovation and the prosperity of society go hand in hand. It is technological innovation that fuels a business enterprise and technological innovation that makes a better world for all.

Over a hundred years of pursuing technological innovation with all the resources at its disposal has made Toshiba what it is today: the ninth largest electrical and electronics manufacturer in the world (1983 *Fortune* magazine survey), with annual sales of $12 billion.

Though we are often perceived outside our home market as a company that primarily makes home appliances and office equipment, we are in fact far deeper and broader than that. We are a thoroughly diversified maker of heavy-duty electrical apparatus and industrial and consumer electronics products. Our capabilities span and interconnect a whole spectrum of specialties.

The major focus of our present efforts is on electronics-related technology development and on alternate energy sources—two fields that will have an enormous impact on the world of tomorrow.

Energy is crucial, and more and more the paths to energy—as well as to almost everything else—are converging through the miracle world of electronics. And electronics is the base technology that anchors Toshiba's diversified product lines. We have long been a leader in the electronics field, and to maintain our lead we are spending more than half of our annual $1.5 billion R&D and plant-and-equipment investment budget on electronics-related efforts.

Important electronics milestones we have achieved this year include starting mass production of the 256-K dynamic random-access memory and successfully developing the 1-Mb DRAM. These noteworthy developments in semiconductor technology, which is of course the foundation of electronics technology, are but the latest in a long string of firsts that Toshiba has recorded ever since it introduced the world's then-highest-density complementary-MOS process in 1972.

This year we also completed construction of a superclean research facility, which boasts the highest level of purity in the world—less than one tenth of a micrometer of dust per cubic foot. This remarkable facility will allow us to challenge technological limits and begin experimental development of a 16-Mb VLSI chip.

The rush forward into the new information age is certain to produce frantic changes in both the social environment and market structure. Everything will grow more complex.

In this environment, an intense need will develop for the services of companies that can systematically integrate a number of basic technologies, especially in such fields as office, factory, and home automation, medical electronics, and space and defense system development. Technological integration, in fact, will become the name of the whole game.

Toshiba can already offer this kind of integration and has been offering it for years. But it is my firm belief that to grow and prosper in the future, the company will need something in addition to this proven capability. It will need, I feel, a new and stronger orientation towards the marketplace—a new market consciousness. I have set as one of the most important goals of my presidency the thorough inculcation of this market consciousness in all Toshiba employees—especially in our R&D people.

A top-level update on OKI's multinational strategy for growth -- ours and yours.

For the past few years, OKI has been coming on strong: supporting your growth planning by sharing ours with you, as the computer/communications industry is challenged by that dynamic new market force—the "small-box" revolution.

Everything we've been telling you about OKI's multinational service strategy is rapidly moving ahead. This permits us to help high-technology OEMs meet the new opportunities so rapidly expanding as computing and communication functions converge into increasingly powerful systems for office, factory and home applications.

The industry agrees that the force driving these opportunities is reliable volume availability of high quality, low power CMOS VLSI electronic devices. In response, we have committed heavy time, manpower and capital resources to:

- Expanding our total-system CMOS capabilities to cover every VLSI memory, microchip, master-slice (gate array) and custom requirement for more compact, more portable small systems.
- Expanding our service capabilities by locating marketing, design and finishing facilities where the world's small-box customers are.
- Expanding our technology and volume production capacities in Japan where the world's silicon foundry is.
- Expanding our multinational alliances, through co-production ventures with major American IC suppliers.

Updating OKI's worldwide progress is Mr. Yoshio Masuda; Chairman of OKI Semiconductor, President of OKI Electronic Devices Group and Senior Managing Director of OKI Electric Industry Co., Ltd.

Update: Now under roof—a 500,000 sq.ft. expansion of OKI's $360 million Miyazaki plant, one of the world's most highly automated manufacturing facilities. Where 5″ wafers, 2 micron CMOS technology, and totally robotized wafer-handling and chip assembly are boosting capacity to 100K wafers/month: high-density NMOS memory including the 256K DRAM, with 1 megabit devices upcoming; CMOS gate arrays to 10K gates; single-chip microprocessors to 32-bits, 4- and 8-bit MCUs.

Update: Now completed—technical alliances with two multinational IC leaders. OKI is the company that wrote a world-market MPU licensing agreement with Intel Corporation, and the IC co-development deal with National Semiconductor. With more to come.

Update your IC-supply strategies: OKI's strategy for growth is designed to meet your new small-system needs with reliable product and multinational support. If you're ready to update your sourcing, we're ready to talk:

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Company, Ltd.
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YOKOGAWA HOKUSHIN ELECTRIC

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equipment manufacturers, the level of dependence upon imports has declined. In the area of steppers, for example, imported products accounted for over 70% of the total in 1981. At present, this figure is below 50%. Likewise the share of imports for equipment as a whole has decreased from roughly 70% in the latter half of the 1970s to some 30%.

New Role for Importers

Accompanying this trend, the role of importing firms has also changed substantially. Since the share of imported products is currently on the decline, limited mainly to the most advanced fields, it has become more important for these firms to promptly unearth products supplying the newest technology and to introduce them to the domestic manufacturers.

It has also become necessary for these firms to make various moves into the sphere of production activities as partners in joint ventures. Tokyo Electron Ltd. exemplifies the earliest adaptation of this sort. It has already formed joint ventures with such U.S. corporations as Thermco, Varian, and GenRad.

Meanwhile, the overseas activities of Japanese manufacturers have picked up as their technological capabilities have improved. Beginning with the export of assembly-related equipment, such as dicing saws and bonders, these firms have now begun to export more sophisticated gear, such as steppers, projection aligners, and LSI testers.

New Firms Enter

The expansion of the market has stimulated new entries into the production-equipment field on the part of corporations which previously stood apart from it. This trend is illustrated

CORPORATE STRATEGIES

Matami Yasufuku
executive director
Fujitsu Ltd.

Fujitsu has developed into an all-embracing electronics firm featuring data processing systems. This was largely made possible by the high reliability and high performance of the company's semiconductors, the most essential part of data processing systems. In fact outstanding performance and reliability have been the hallmark of Fujitsu semiconductors ever since these devices first made their appearance on the world market.

These attributes eventually led to worldwide praise for Fujitsu's integrated circuits and particularly in the booming memory market. Fujitsu's first-rate production capability, proven in its highly successful 16-K dynamic random-access memories, also brought instant success to the 16-K DRAM's successors—64- and 256-K chips. Today Fujitsu ranks among industry leaders in such memory areas as programmable read-only memories, erasable PROMs, and bipolar memory chips. The company is continuing all-out efforts to come out with even more sophisticated memory products in the future.

In the field of logic chips, Fujitsu's early prediction of growing demand for customization helped the company complete 8,000-gate complementary-MOS and 2,000-gate bipolar gate-array product lines. Since the market for semicustom large-scale ICs is expected to continue expanding, Fujitsu has inked second-source contracts with Texas Instruments Inc. and Monolithic Memories Inc., both of the U.S., to better serve American customers. Fujitsu is also boosting its computer-aided design system capability, crucial in customized semiconductor production, and is planning to open more design centers abroad, in addition to the centers already serving customers in the U.S. and Europe.

Microprocessors from Fujitsu are based on Intel Corp.'s products and come in 8 and 16 bits. Related product lines will be expanded.

With demand for semiconductors forecast to continue its strong growth in years ahead, Fujitsu is aggressively investing capital in expanding and establishing more plants and facilities in Japan to meet that demand. Abroad, the company operates production plants in the U.S. and Ireland.

In a fiercely competitive market in which technological level can spell the difference between life and death, Fujitsu is taking precautionary measures to keep ahead. The company has and will continue to devote a large part of its earnings to R&D for next-generation ICs. Already, its R&D efforts have been paying off. Further, Fujitsu is striving to earn a reputation for itself as a leader in III-V semiconductors, such as gallium arsenide ICs.

Always looking far ahead, Fujitsu is determined to provide customers with ever increasing varieties of high-tech semiconductors.

STOP! The Malfunction

That's Our Mission

Since our company was founded, we have been exclusively involved in the manufacture and sales of noise-related testers and measuring equipment that are indispensable for devising effective countermeasures for malfunction of digital equipment. It is with confidence that we can recommend you our "NOISE" brand products that have been designed to achieve greater reliability in electronic goods.

Our products are the fruit of our continued effort to adopt the latest technology into our research and development works.

We shall continue to make even greater efforts to produce testers and measuring equipment that will help you manufacture reliable products that do not malfunction.

IMPULSE NOISE SIMULATOR
MODEL NS-810A

Model NS-810A is a device to simulate the switching impulse of the power line systems. With this NS-810A, you can simulate quantitatively the noise entering via the power line systems, the noise on the signal line acting as a receiving antenna and others.

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MODEL ES-820A

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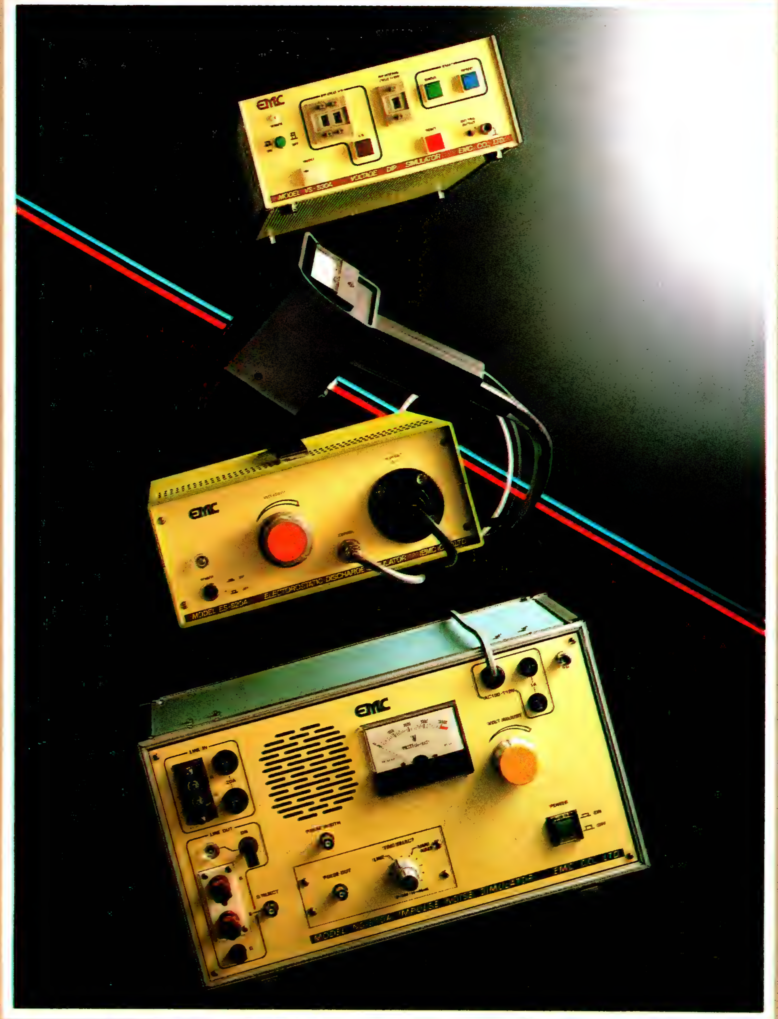

VOLTAGE DIP SIMULATOR
MODEL VS-830A

In resent years, the source voltage is subject to fluctuation due to the development of switching power supply. Model VS-830A has been developed to test the effect that momentary power interruption has on electronic equipment.

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by Japan Steel Work's introduction of an X-ray aligner using a small synchrotron orbital radiation ring, as well as by the entry of both Nisshin Electric and Sumitomo Heavy Industries into the field of ion implanters and by Ushio Electric's entry into the field of annealing equipments.

As well as being bouyed by these currents of change, Japan's semiconductor-equipment industry is entering upon a new period of internationalization ushered in by the entry of domestic manufacturers into foreign countries and the formation of joint ventures with foreign companies domestically. Thus it appears certain that this industry can look forward to a dynamic expansion in the years ahead.

CORPORATE STRATEGIES

Yoshio Masuda
senior managing director
and president
Electronic Devices Industries Group
Oki Electric Industry Co.

Rapid growth will be Oki Electric's paramount goal throughout the 1980s. Sales in fiscal 1983 topped $1.3 billion, representing a 30% increase over the previous year. This places the company firmly on its way towards an annual sales target of $5 billion by 1990. To reach this goal, however, will require good performances by each group in the company: telecommunications, data processing, electronic devices, and office automation products.

Long before the electronics industry pulled out of the recession in 1983 and analysts began predicting a banner year in 1984, Oki Electric began laying the groundwork for growth. The company decided very early that very large-scale integrated memory circuits and complementary-MOS microprocessors in particular would experience tremendous demand in the 1980s. Accordingly, Oki's Miyazaki plant introduced its first VLSI device, a 64-K dynamic random-access memory, in 1981.

Today, the Electronic Devices Group has adopted the slogan "3M+C." The Ms stand for memory, microprocessor and master slice, (gate arrays), while the C signifies CMOS and the ideals of communication, computation, and custom-tailored products. In terms of action this means that the new Miyazaki plant (module No. 2) has now been built to start producing 256-K DRAMs with 2-μm geometries and arrays with up to 10,000 gates, using ultramodern automated facilities. Moreover, the plant will be expanded to triple Oki's capacity by 1985. At the Hachioji plant, R&D teams are working on the next step; the production of 1-Mb chips by 1987.

In the area of CMOS technology, Oki has developed a particularly strong position enabling it to garner a growing share of the demand for CMOS ICs from all sorts of battery-operated "small boxes," including watches, cameras, and portable computers. Oki already has the lion's share (30%) of the digital-watch IC market, and its market share will grow in new areas as the company moves to supply major auto manufacturers, as well as computer and appliance makers.

This success has been founded upon first-class quality, which Oki Electric achieved by systematically applying its total quality control (TQC) philosophy to every department activity; from marketing and product planning straight through to after-sales service. Management has made a lasting commitment to employee participation, training programs, high standards, and a feedback system to assist job analysis at every level.

Moreover, the latest technology is constantly being introduced to improve methods of design, production, environmental control, material inspection, and product reliability testing. These are not new ideas, but Oki has thus earned the highest quality ratings from its clients, including major international mainframe manufacturers.

Internationally, steps are being taken to strengthen our overseas subsidiaries and form technical agreements with leading manufacturers. The latter include an IC co-development program with National Semiconductor Corp. and a licensing agreement with Intel Corp.

Under the Intel agreement, Oki will be free to develop, manufacture, and sell CMOS products compatible with four families of Intel microprocessors and microcomputers, including the 80C86/80C88 16-bit microprocessors, the 80C51 8-bit microcontrollers, the 80C85A 8-bit microprocessors, and the 80C48/49/50/51 8-bit microcomputers. This agreement not only enhances Oki's position with existing clients, but also smooths its entry into the worldwide CMOS market.

Deep Space On Our

Doorstep

Photo courtesy of The Institute of Space and Astronautical Science, Ministry of Education, Japan.

Inside this room is a little dollop of deep space—courtesy of Tokin technology.

It's a totally enclosed test chamber, a room shielded so well against the influence of outside fields that it actually duplicates the magnetic conditions found far beyond the earth's atmosphere.

By applying a Tokin-developed permalloy in a three-shell spherical structure, we were able to cut the field inside to about 1/2000th of the magnetism normally found on earth.

Among other possibilities, this room means that man-made satellites—including the one designed to observe the effects of Halley's comet and "solar wind" for Japan's PLANET-A project—can be tested free of magnetic interference *before* launch.

But this deep-space chamber is just the latest frontier in a long series of Tokin firsts.

From simple but superior magnets and metal magnetic materials, ceramics and components, to sophisticated equipment for combatting electronic interference and noise, Tokin has been in the forefront of technology for a long time.

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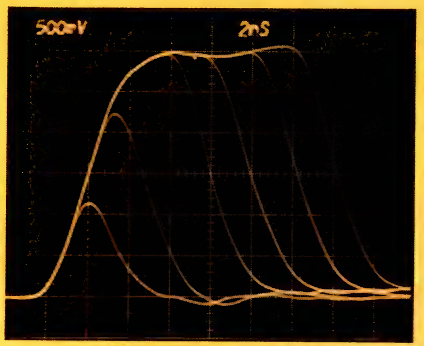

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OPTOELECTRONICS

Industry is growing rapidly as communications applications spread

by Naoki Ikezawa

The Japanese optoelectronics industry is experiencing a rapid growth that is centered around optical communications. The products of the optoelectronics industry range over diverse fields, but this account will focus on the latest trends in Japan in optical fibers and laser diodes, which are products of particular importance, and on the optical local network, which is proceeding toward practical utilization.

The optical-fiber type that has demonstrated the most dramatic growth is silica monomode fiber. This is due to its probable utilization by Nippon Telegraph & Telephone Public Corp. in the planned optical trunk line running down the length of Japan.

According to data released by the Optoelectronic Industry and Technology Development Association, the domestic demand for silica monomode fiber totalled about 44,000 km for 1983, representing over 60% of the demand for silica fiber at a whole. However, trunk lines are not the only area of optical-fiber utilization; studies are also being conducted upon the practical utilization of optical communications in the subscriber system, primarily as part of the INS (Information Network System) project.

Also, efforts are moving ahead to develop other services that would use the optical phone technology, such as high-speed facsimile, cable TV (CATV), home banking, and home shopping. In developing optical devices for home use, particular attention is going into improving temperature

Optoelectronics in Hong Kong is a lightwave communications network, where Fujitsu personnel are splicing optical fiber.

Have You Looked Into the Economical and Useful

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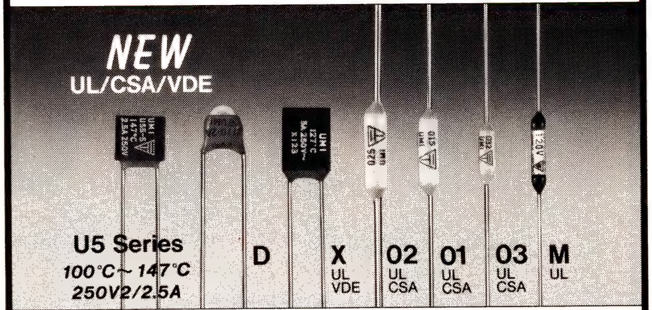

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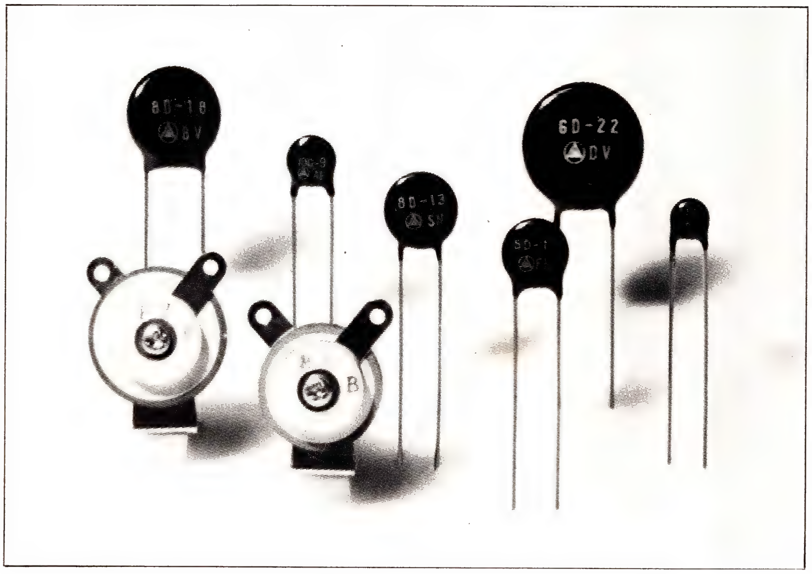

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sensitivity and finding an easy method to connect fibers.

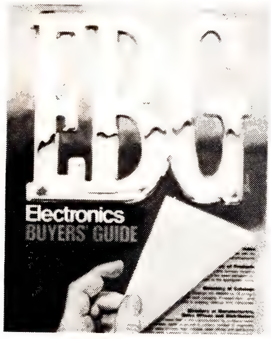
In the U.S., with its average interval of about 40 km between subscriber and the exchange, optical fiber is finding increased application in the subscriber loop carrier (SLC), which makes full use of lightwave transmission's low attenuation and high capacity. In Japan, by contrast, the average interval between subscriber and the exchange is only 2 km. Thus there is a strong possibility that the application of optical fiber to trunk lines, will be followed by immediate introduction into subscriber lines, rather than into the SLCs. If optical communication is used even in the subscriber system, which encompasses 36 million households across the country, it is likely that this would generate a demand for optical fiber anywhere from 10 to 3,100 times the scale of the existing demand for silica monomode fiber.

Laser Diodes

Of course, fiber cables are only the starting point in optical communications: equally important are transmitting and receiving devices. Yet the recent expansion in the demand for laser diodes has been fueled not only by increasing utilization as optotransmitters, but also by their introduction into compact-disk digital audio players. According to the data of the Optoelectronic Industry and Technology Development Association, the 1983 domestic demand for communications laser diodes totalled approximately 10,000 units. In contrast, the 0.78-μm-band laser diodes totalled some 500,000 units, with at least 400,000 being used in CD players and the others in laser printers, video-disk players, and so on.

The price of 0.78-μm-band laser diodes has plummeted with this burgeoning demand. It is estimated to have dipped below the $5 per unit mark as of 1983.

The manufacture on a trial basis of a five-wavelength WDM (wavelength-division multiplexing) module realized



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As mentioned above, we have been attaching importance to international tie-ups or subsidiary corporations. In addition, we are determined to keep watch on trends in technology and consumer needs and to supply control components that meet the new age.

---

through integrated laser diodes can be cited as one of the latest results of the intensive research and development in this field. This module represents one of the achievements of the large-scale optical project that is currently being promoted by the Agency of Industrial Science and Technology within the Ministry of International Trade and Industry.

Projections are that this technology will be capable of practical utilization in the next 3 to 4 years. This will facilitate the multiplexed transmission of analog signals such as of CATV and digitized voice and data signals on a optical fiber.

Optical Local Nets Flourish

Although the concept of the LAN, or local-area network, is not premised upon the utilization of optical fiber, the pace of development in Japan of the two technologies is simultaneous. Thus the majority of the LANs being marketed use optical fiber.

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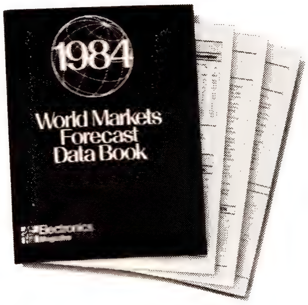

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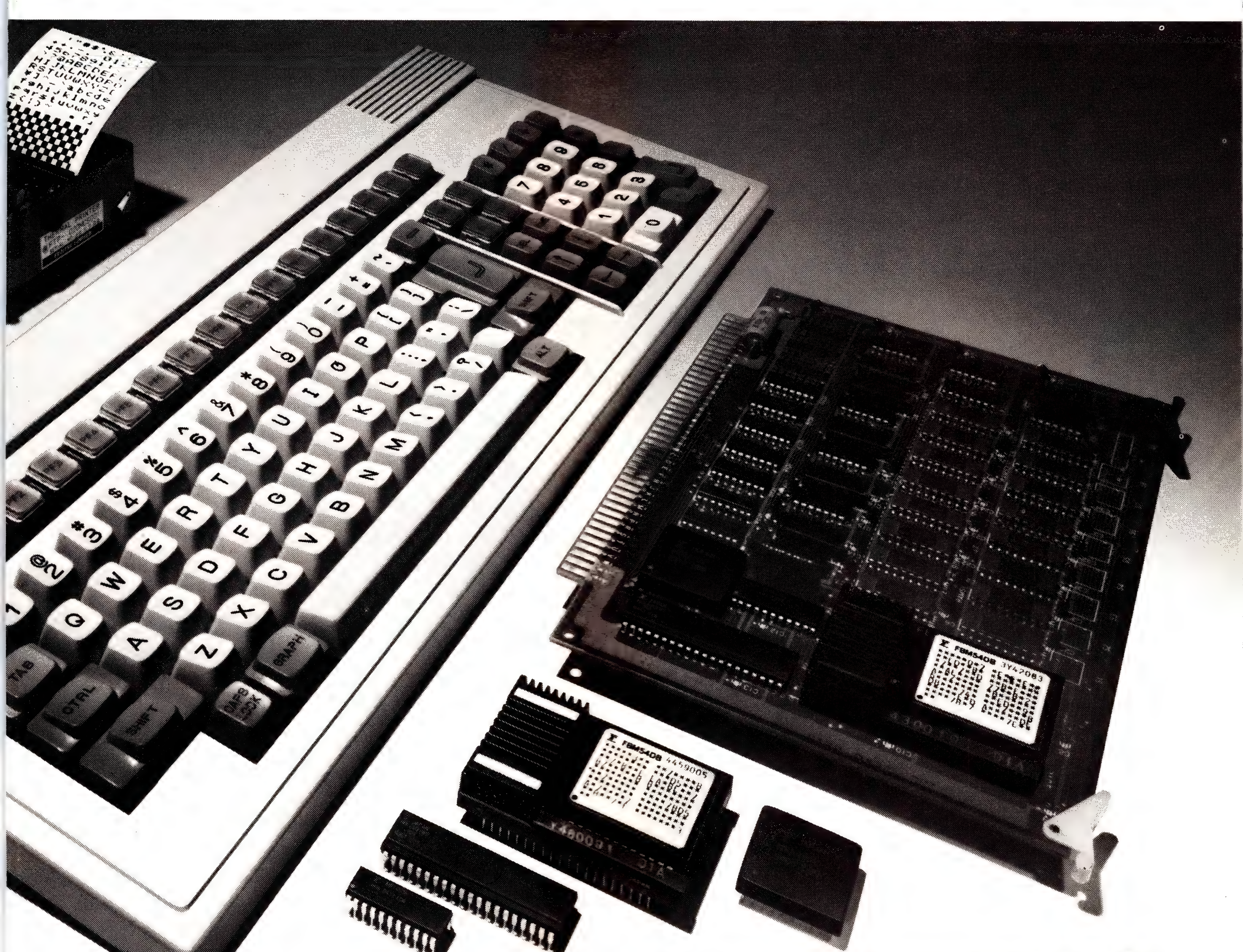

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fiber applications in office and factory automation in order to obtain the fullest benefit from the advantages provided by lightwave transmission. This, too, can be termed a point of difference with respect to the U.S.

Full use is also bring made of Japan's advanced semiconductor technology in the optical local-network field. Recently, custom large-scale integrated circuits capable of supporting 35-Mb/s transmission rates have appeared, and it is anticipated that they will contribute importantly to the expected market penetration of optical LANs.

New Fields in Sight

The expansion of Japan's optoelectronics industry thus far has centered around optical communications, and most importantly the telephone network over which NTT exerts exclusive control. Nevertheless, the various fruits of this effort, as exemplified by high-quality fiber produced through vapor-phase axial deposition, integrated laser diodes, and optical-link LSI chips, lead to the conviction that this industry is sure to make rapid inroads into a wide range of fields in the years ahead.

COMPUTERS

Developing fast, personal computers will enter the world market

by Shinji Yamane

Japan's manufacturers of computers and peripheral equipment continue to experience rapid growth. Exports recorded a phenomenal hike of 679 billion yen in 1983, compared to the previous year's 340 billion yen. The total 1983 output of these firms was valued at 1,861 billion yen, as opposed to 1,553 billion yen in 1982.

Improved competitiveness of Japan's computer industry is not only based on exports of mainframes and their peripherals but also stems from the burgeoning personal computer market both domestic and overseas. In particular, Japan's peripheral equipment for personal computers and word processors, such as serial printers and floppy disk drives, are highly competitive items in the world market.

In the coming year, it is expected that Japanese personal computer systems will start full-scale entry into the world market, building on the market presence of peripheral equipment. At the other end of the computing spectrum, supercomputers are also likely to penetrate into the world market.

At both the low and high ends of the computer market, then, Japan is stepping into the world. Of these two market sectors, personal computers are the more important item for Japan's computer industry.

As the table on p. 96 shows, personal computer shipments in fiscal 1983 reached 342 billion yen in terms of value and 1,141,000 units in terms of volume. These figures represent increases of 48% and 50%, respectively, over the previous year.

Domestic shipments were 885,000 units, and export shipments accounted for 256,000 units. Of the total shipment, then, 78% were domestic. It should be noted, however, exports are

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Masanori Kogo, president
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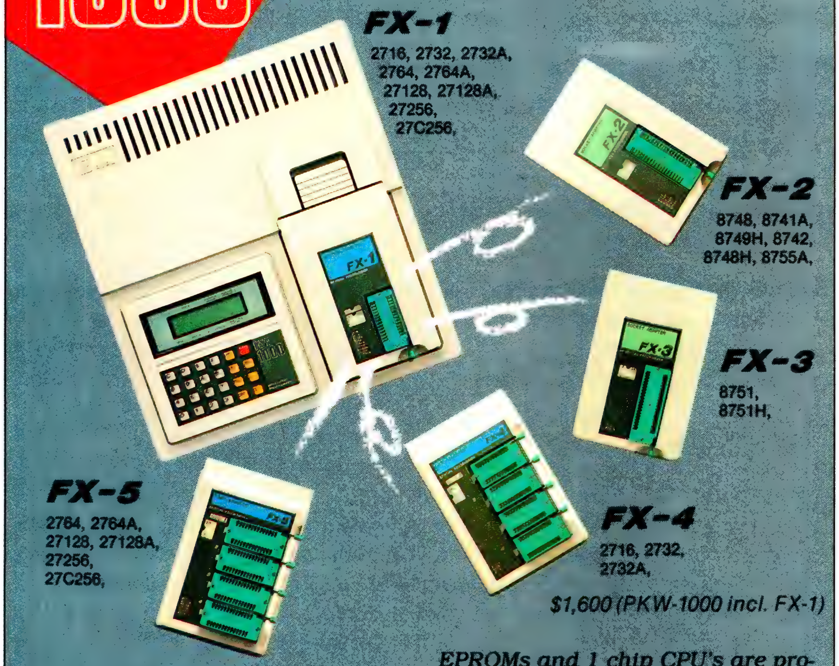
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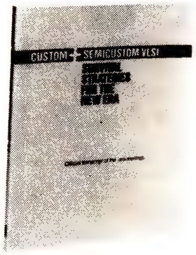

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growing steadily: fiscal 1982 sales were 90% domestic.

The software market was on the order of 70 billion yen, representing a sizzling increase of 113% over 1982. As matters now stand, however, the scale of the software market is only about a fifth that of the hardware market.

Breaking down the total domestic shipments by application, it is estimated that business use accounted for 40% of the total units; scientific, engineering, instrumentation, and process uses 13%; and educational, hobby, and home uses 47%. Units based on 8-bit microprocessors took 82% of the market, with the rest going to 16-bit-based machines. The market share of the 16-bit machines is rapidly rising in the business, scientific, and engineering fields. In the educational and consumer fields, however, 8-bit machines will continue to dominate, due to the debut of the Z80-based MSX standard, supported by a number of manufacturers.

A Low-End Market

In terms of price, systems costing 200,000 yen or less accounted for 70% of the total, while those in the 200,000 to 1 million yen range and those over 1 million yen accounted for some 26% and 4% of the total, respectively. It is the systems priced below 200,000 yen that are primarily applied for educational, hobby, and home use.

NEC, Sharp, and Fujitsu have achieved a product coverage in every price segment, by virtue of which they constitute the major force in the market. More specifically, NEC Corp. leads the market with its best-selling PC8801MKII and PC9801. Similarly, its PC-100 has been marketed as a low-priced version of the Lisa type of personal computer with bundled standard software. This model has been highly rated in terms of its cost-performance ratio. However, the software cannot be said to have attained sufficient sophistication.

Sharp Corp.'s X-2, as its name Personal Computer TV suggests,

Shozo Yokogawa, president Yokogawa Hokushin Electric Corp.

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combines TV and personal-computer functions. It has garnered attention in that it presents a new type of product. The firm also markets a full range of personal computers.

Fujitsu Ltd. is marketing a series similar to that of NEC. It is clear that Fujitsu is opting for the fullest application of advanced semiconductor technology, as evidenced by the employment of 256-K dynamic random-access memories in the FM77.

SORD Computer Systems Inc., a personal computer specialist, has a line of products centered around business use and has demonstrated considerable strengths in this range. IBM Japan Ltd. is marketing only one model, the IBM 5550, for business use. It has built up a fairly impressive record, although the 5550 does not match the U.S. market performance of the IBM Personal Computer.

As for market shares, NEC, Sharp, Fujitsu, Matsushita, and Sony have won high shares in the home use market, with the top shares in the high-end portion of this market belonging to NEC, Sharp, and Fujitsu. The leading shares in the business market belong to NEC, SORD, IBM, and Fujitsu. The hardware product cycle is short in the

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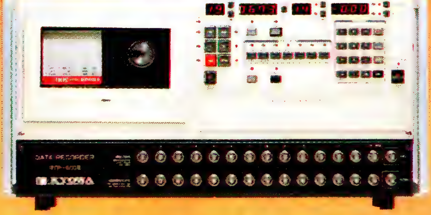

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case of personal computers, and there are numerous instances of products being launched into the market with the addition of various technological improvements. Several important trends can be discerned in this environment.

The first trend is software adaptation. Japanese-language operating systems have become the standard, as represented by the MS-DOS (Version 2.0) and CP/M-86 (Version 1.1). On-screen information can be displayed in the Japanese-language syllabary and ideographs in place of the Western alphabet, resulting in greater user friendliness for the Japanese.

Similarly, all manufacturers market models equipped with a mouse, thus improving the man-machine interface. Word-processing and graphics software have been adapted to the use of the mouse, but it cannot yet be termed fully adequate in respect to easy usage.

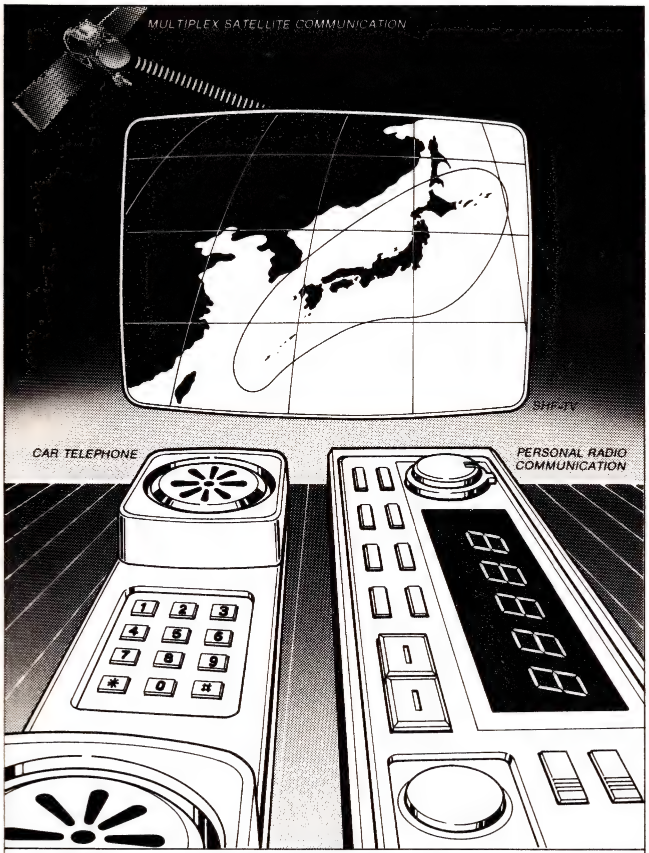
The realization of highly user-friendly software will thus become a development theme in the years to come. In that such software would offer freedom from keyboard operation, to which Japanese users are not completely accustomed, it can be considered an important step.

Graphics Functions Improve

A second important trend is the steady improvement of graphics functions brought on by the increase in memory space, high-performance 16-bit microprocessors, and higher-resolution screens. Stimulating this trend is the need in business displays for a 16-by-16-dot ideogram, at the minimum, and the requirement for high-resolution graphics in computer-aided design and manufacturing.

NEC's μPD7220 and Texas Instruments Japan Ltd.'s

One use for home computers, envisioned by NEC Corp. and others, is as an intelligent terminal for services like educational games.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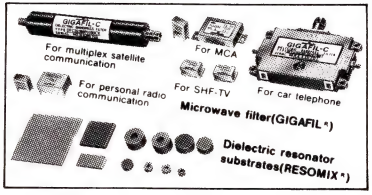
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JAPANESE MANUFACTURERS' SALES OF PERSONAL COMPUTERS

Fiscal year	Hardware (thousands of units) Total shipments	Hardware (thousands of units) Domestic shipments	Hardware (thousands of units) Export shipments	Hardware (billions of yen) Total shipments	Software* (billions of yen) Total shipments
1981	283	229	54	107	10
1982	762	683	79	231	30
1983	1,141	885	256	342	70

Source: JEIDA, except *based on various publications

TMS9918A are examples of the cathode-ray-tube controllers currently employed to satisfy these needs. Likewise, various firms are marketing personal computers with bit-map displays in a bid to realize three-dimensional graphics.

In terms of the microprocessors used, the Z80 (in the 8-bit arena) and the 8086 and 68000 (in the 16-bit arena) consititute the mainstream technology, and U.S. manufacturers hold sway. Recently, however, Japanese manufacturers have begun to develop original chips.

This trend is exemplified by NEC's 16-bit V20 with an 8-bit external data bus and 16-bit V30 with a 16-bit external data bus, as well as its planned development of the 32-bit V70 by 1986. Thus, although microprocessors represent the only components in which Japanese manufacturers were lagging, indications are that home-produced parts will gain momentum in the years ahead.

The increasing adoption of a 3.5-in.

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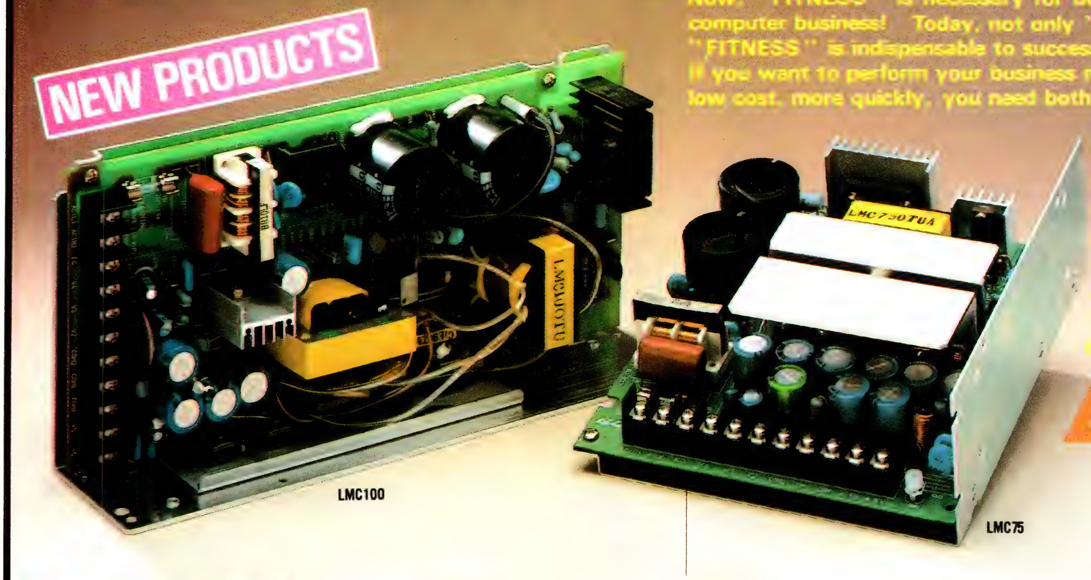

■KMC Series 110/220V Single input/Triple output.

KMC15-1	5V2A	12V0.3A	−12V0.2A		**KMC30-1**	5V3A	12V1.2A	−12V0.3A
KMC15-2	5V2A	15V0.2A	−15V0.2A		**KMC30-2**	5V3A	15V0.5A	−15V0.5A
2KMC15-1	5V2A	12V0.3A	−12V0.2A		**2KMC30-1**	5V3A	12V1.2A	−12V0.3A
2KMC15-2	5V2A	15V0.2A	−15V0.2A		**2KMC30-2**	5V3A	15V0.5A	−15V0.5A

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LMC100	5V10A	12V2.5A(3.5A)	12V1.2A(2.0A)	−12V0.5A	**LMC135**	5V12A	12V1.2A(2.0A)	12V3.5A(6.0A)	−12V1.5A

■K Series 110V Single input/Single output.

K15	5V3A	12V1.3A	15V1A	24V0.7A	**K25**	5V5A	12V2.1A	15V1.7A	24V1. 1A
K 50	5V10A	12V4.2A	15V3.4A	24V2.1A					

〔Figure in ( )indicate Peak current.〕

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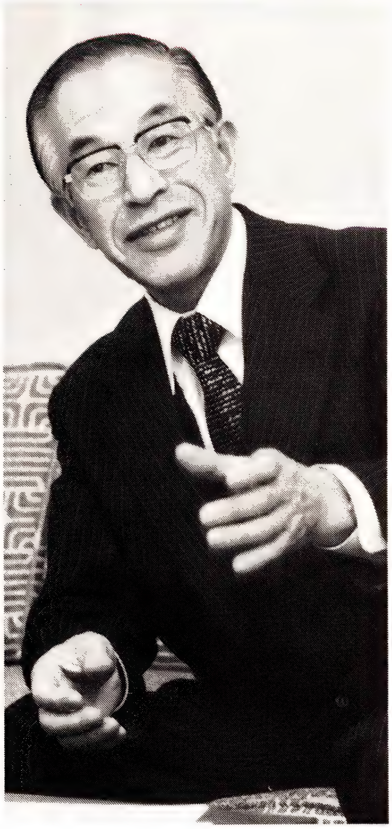

Reishiro Endo, president Minato Electronics Inc.

Minato Electronics has developed in step with the remarkable growth of the world semiconductor industry. As one of the three major Japanese makers of test systems for large-scale and very large-scale integrated circuits, Minato Electronics is increasing exports in response to frequent inquiries about LSI memory test systems and the XBM bit-map systems, mainly from the U.S. and Europe.

We have developed the state-of-the-art very small 9400M Memory Test System, which implements signifcantly enhanced functions and will meet the requirements of customers. We are receiving many inquiries about our 2300 CCD test system, which makes it possible to mass-produce a charge-coupled device of the type that is in the spotlight as a new image sensor for video cameras.

Our lineup of programmers for programmable read-only memories includes compact and gang types, as well as multifunction types that are capable of programming field-programmable logic arrays, Programable Array Logic, and bipolar PROMs and anticipates the 256-K era. An extensive sales network covering contractor agents in 25 countries has been established.

Newly introduced in Japan are Touch Data, the display of which is changed only by touching its color cathode-ray tube, and the Virtual Server, which concentrically controls a number of different personal computers on a local network. They are finding favor with customers due to their up-to-date unique technology corresponding to the latest new-media era.

In the future, Minato Electronics will develop unique new products as a venturesome business entity that has the capability for international deployment, on the basis of current state-of-the-art technology backed up by instrumentation.

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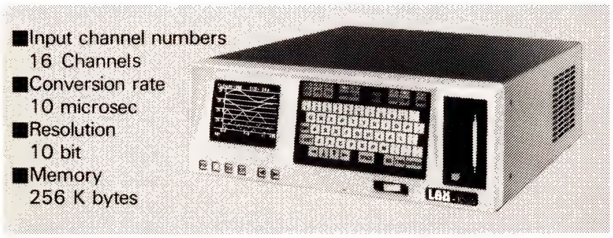

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256 K bytes

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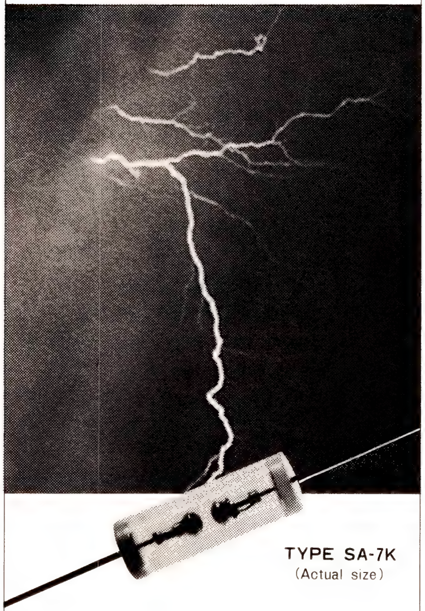

TYPE SA-7K
(Actual size)

● *TYPE*

Type	Breakdown Voltage (V) D	Insulation Resistance (Ω)	Maximum Surge Current (8×20us) KA	Life Times at 500A
SA-80SS	80±10%	10^{10} min	1.0	1000
SA-200SS	200±10%	10^{10} min	1.0	1000
SA-80	80±10%	10^{10} min	1.5	3000
SA-140	140±10%	10^{10} min	1.5	3000
SA-200	200±10%	10^{10} min	1.5	3000
SA-250	250±10%	10^{10} min	1.5	3000
SA-300	300±10%	10^{10} min	1.5	3000
SA-7K	7000±1000V	10^{10} min	—	5000
SA-10K	10000±1000V	10^{10} min	—	5000
SA-180D(3)	180±10%	10^{10} min	2.5	10000

SA-180D(3) is a three electrode discharge tube.
All tubes can be made dark effect redused types which are available upon request. D is added to the model number, as in SA-80DSS.

● *POINT*

(1)Usable at wider ambient condition, especially good under high humidity.
(2)Visibility for operation.
(3)Compact and easy assembly.
(4)Stable characteristics.

TYPE
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● *APPLICATION*

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floppy disk drive can be cited as an important trend in the area of peripheral equipment. In addition, what is called a quick disk has been marketed for low-priced home-use machines such as the MSX. It uses a 2.8-in. floppy disk (64-K on a side), and sequential access takes 8 s. The drive is simple, resulting in a low-cost unit. The appearance of such peripheral gear, priced below the ordinary floppy disk drive, has attracted considerable attention as an emerging trend in the personal computer world.

Color Printers Flourish

The increasing penetration of color displays has spurred the employment of color printers. Quality improvements and price reductions are also making rapid progress, facilitating the full-scale proliferation of this equipment into new fields, in addition to its original applications in CAD/CAM.

As for pricing, seven-color printing has become a possibility in the under 100,000 yen range: in other words, it has become possible to obtain color printing for the same price as monochrome printing. The principal printing technologies are transfer-type thermal, ink-jet, and impact-dot.

It is anticipated that both business and consumer color printers will be developed and that the capablity of printing in a wider variety of colors at lower prices will spread. It is also expected that, as in CAD/CAM, models will be developed that are capable of high-density, high-speed, multicolor (4,096 colors) printing.

As the above account indicates, personal computers and their peripheral equipment are expected to change at a swift pace in the years ahead. It is likely that the emphasis in development will shift from the current general-purpose hardware and software toward application-oriented products. The coming years are also likely to see the development of a super personal computer through which a personal expert system based on artificial-intelligence technology could be realized.

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DC to 12.4 GHz with SH-4B Sampling Head

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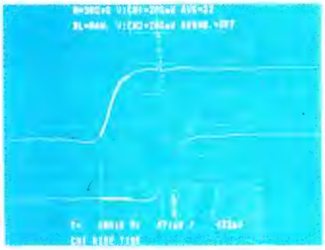
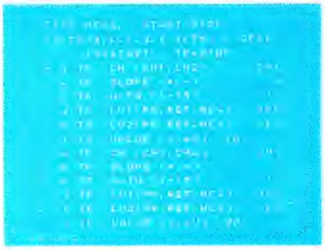
Examples of Time Measurement

Time Measurement of Rise Time



Rise Time Setting



Specifications

• CRT: 7-inch rectangular, 20 kV (approx.) • Frequency response: DC to 12.4 GHz (with SH-4B) • Vertical deflection factor: 2 mV/div to 0.2 V/div • Input R: 50 Ω • Response: variable from 1 to approx. 1/3 • Vertical resolution: 10-bit • Horizontal sampling points: 1023 dots/scan • Sweep rate: 20 ps/div to 500 μs/div • Power: 110/117/217/234 V AC, 200 VA • Weight: 24 kg • Dimensions (approx.): 420(W) x 222(H) x 550(L) mm

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COMMUNICATIONS

In a rapidly changing business environment, the pace of technology development is quickening

by Shigeaki Kaneyori

Japan's communications equipment industry is facing a rapid change of business environment. There are five principal factors responsible for the quickening pace of technological development.

First of all, the infrastructure that will facilitate the use of advanced communications equipment is under development. A primary example is the Information Network System (INS) of Nippon Telegraph & Telephone Public Corp. INS is to be an all-digital countrywide network handling telephone, telex, facsimile, data, and video communications. Another is the Teletopia plan of the Ministry of Post and Telcommunications to expand communications in large cities through such means as fiber-optic and satellite technology.

Other examples are Captain, which is a videotex service promoted by NTT, and a satellite communications service from NTT, to start this year. Also, a satellite broadcast service by the Japanese public broadcasting system NHK got under way this year, and enhanced CATV (cable TV) service is to be implemented over the next several years.

Relaxing the Regulations

The second factor is liberalization of communications regulations, now in progress. After the revision of the public telecommunications law in 1982, new laws that promote further relaxation of regulatory procedures are expected to be passed this year—or by next year, at the latest.

These new laws will permit private

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companies to enter various types of telecommunications services presently monopolized by NTT—for example, trunk-line service based on fiber-optic cables and satellite transmission and value-added-network (VAN) service. Also, the construction of the infrastructures necessary for these services will be permitted not only by NTT but also by the private sector.

The third factor is various standardization efforts being implemented by Ministry of Post and Telecommunications, NTT, the Ministry of International Trade and Industry, and so on. Examples are standardization for MCA (multiple channel access) service, Japanese-language teletex, and protocols for personal computer communications, for the home-bus system, for a credit-authorization network, for business banking transactions, and for order transactions between supermarkets and wholesalers, for example.

These three factors are activating the demand for new types of communcations equipment that are emerging due to the convergence of information processing and telecommunications technologies. Examples are digital private branch exchanges, local networks, and portable MCA transceivers (for what is called "personal wireless" service in Japan).

Exports on the Upswing

Finally, the export of key telephones, digital PBXs, and facsimile machines is rapidly increasing—and it is becoming a trade issue. Internationalization of production is required for Japan's communications equipment industry. For example, NEC, Fujitsu, Oki, and Hitachi have started production in the U.S. in order to cope with local demand as well as to avoid trade conflicts.

Reflecting the impetus provided by these five factors, product development by Japan's communications equipment industry is being vigorously conducted. An overview of recent developments in major fields of communications equipment follows.

In Japan, the installed number of LANs (local-area networks) is limited, although a variety of products is available both from Japanese vendors and from overseas suppliers. Currently about a thousand LAN systems are installed: 90% being in factories and 10% in offices. Popular products are loop-type LANs based on fiber-optic technology.

Recent product developments in LANs focus on personal-computer local nets. Among the products from NEC, Fujitsu, and IBM Japan are systems supported by wireless links employing laser, infrared, or radio

CORPORATE STRATEGIES

Yugo Fujita, president
Anritsu Electric Co.

With its early perception of the unique promise held by digital and fiber-optic transmission technologies for the envisioned integrated services digital network (ISDN), Anritsu has been developing the basic technology for optoelectronics—laser diodes and measuring instruments for optical communications—for more than 15 years. The effort based on a long-range corporate strategy has resulted in a rich harvest: our measuring instruments for optical communications now stand out as some of the most vital among our line of telecommunications equipment and measuring instruments. Our latest laser diodes boast the world's highest output power.

With its position as a world leader in measuring instruments for fiber-optic communications, Anritsu is confident that such instruments will help accelerate the progress of ISDNs around the world.

In every field of endeavor, Anritsu's growth has always been based on our long-range corporate strategy. The company that later became Anritsu was established as a manufacturer of telecommunications equipment in 1895. Some 50 years ago, we entered the field of industrial measuring instruments for telecommunications and then that of industrial measuring instruments.

More recently, we added terminals and information processing peripherals. At the same time, we have accumulated significant mechantronics technology, which finds its ways into virtually every one of our product lines. These four main areas of expertise can be expressed in a single simple phrase: "T^2M^2" (for telecommunications, terminals, measuring equipment, and mechatronics).

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communications, thereby reducing construction costs.

On the other hand, digital PBXs are burgeoning in spite of the fact that the current demand is mainly for simple replacement of the traditional analog PBXs and not for sophisticated applications of integrated office systems. Suppliers of digital PBXs are Hitachi, NEC, Fujitsu, Oki, Toshiba, Iwatsu, Matsushita Communications, and NTT—as well as Rolm, Northern Telecom, and Mitel, distributed by Omron, Iwatsu, and Pioneer Answerphone, respectively.

Digital PBXs are Popular

Among these, small digital PBXs pioneered by NEC Corp. and now offered by other firms are particularly noteworthy. NEC's APEX-D2 achieves its small size by using custom large-scale integrated circuits. It can provide 24 extension lines and 8 subscriber lines at a price of only 800,000 yen, which is less than the traditional analog electronic or crossbar PBXs.

This category of PBXs is being marketed to small firms, including those in the key-telephone market segment. Moreover, it is expected small digital PBXs used as the hub of of home automation will be developed by Sharp Corp. and others.

As for home automation, there are two trends. One is the development of home bus system, which will be used to link various pieces of computerized and electronic equipment. Standardization is being carried out the by Ministry of Post and Telecommunications with NTT and by the Kansai Electronics Industry Promotion Center that is part of MITI.

There will be two standards for home buses. The major difference is that one employs packet switching on a coaxial network, and the other employs circuit switching on a mix of coax and twisted-pair wires. Another development of the home bus utilizes the home ac lines.

On the Home Front

The second trend in home automation springs from the expected end to the NTT monopoly over first telephone purchases. (The first time a user establishes service, he must buy his phones from NTT.) Telephone manufacturers, including potential entrants, are developing new equipment in anticipation of a booming domestic market for telephone sets. Consumer electronics manufacturers, such as Matsushita and Toshiba, are especially active, as they see the set

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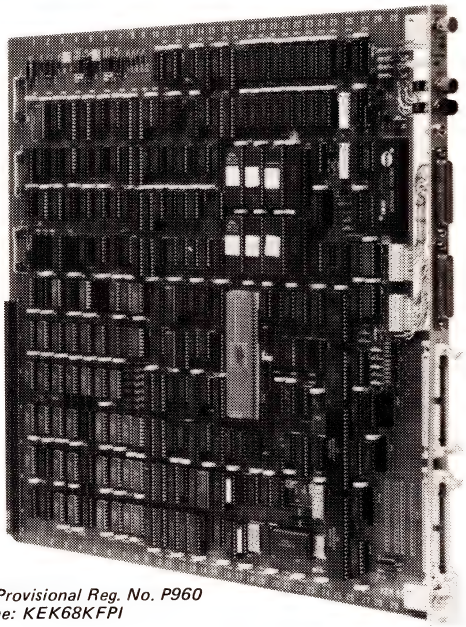

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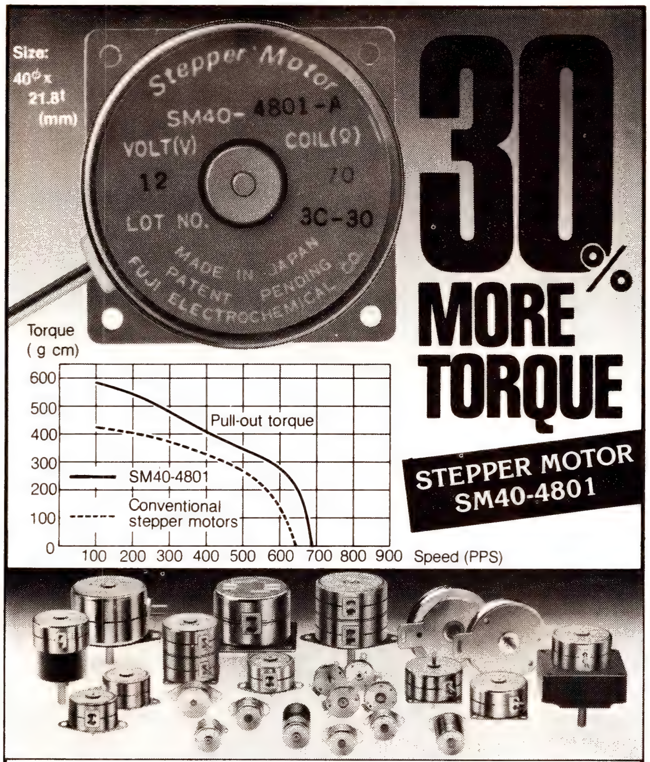

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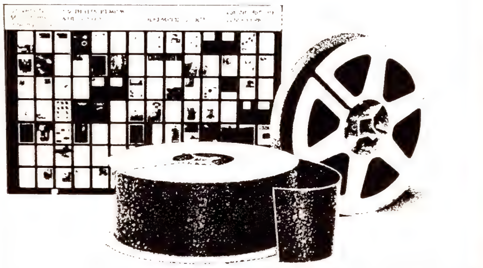

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business is an important milestone for the future home-automation business. Already they have developed telephone-based automation systems featuring home security and telecontrol over appliances.

The liberalization of the rules on first-phone purchases will take effect next spring. However, the introduction of the cordless telephone will be delayed. The extremely high population density in Japan requires more consideration for cross-channel interference than in the U.S. There are various technologies under development, such as the ones using a bucket-brigade-device delay circuit, spectrum scattering, and a fast Fourier transform scrambler.

New Communications Highways

This year NTT is scheduled to start high-speed (64-kb/s to 6-Mb/s) digital leased-line service based on fiber optics and satellite transmission, as well as a video communications service using the satellite. One application for these high-speed services will be videoconferencing. Fujitsu Ltd. worked with NTT to develop a video data-compression encoder that reduces signal volume to 1/60 that of the traditional frame-to-frame differential encoder and thus realizes video data transmission at only 1.5 MB/s.

Another application for these services will be integrated communications for telephones, PBXs, facsimile machines, and computers. NEC and Fujitsu have developed multimedia digital multiplexers that encode voice by adaptive differential pulse-code modulation. This technique compresses the signal to half that required by traditional PCM.

Also, this year Captain is scheduled to start commercial service in the Tokyo metropolitan area. Telecommunications manufacturers are readying equipment for this videotex service: TV sets with RGB interfaces, videotex adapters, equipment for information providers, and in-house videotex systems for business users.

Since it is expected that business users will be dominant in the early days of videotex, current development emphasizes business products. Leading the market for in-house business videotex systems is the Canadian-developed Telidon (distributed by Mitsui & Co.).

NTT's Plans for the Future

As for future products, NTT is developing digital 16-kb/s voice and data transmission equipment and a digital phone that can transmit a 64-kb/s voice signal simultaneously with a 16-kb/s data signal. Also, it is working on a computer based on artificial-intelligence technology, intended to translate between natural languages in the forthcoming INS. The 1983-90 budget for this AI computer is 155 billion yen.

Meanwhile, in Mitaka City, Tokyo, NTT plans to start a prototype INS service this fall with the participation of various industries. The experiment uses digital fiber-optic subscriber lines and cables and includes digital phones, sketch phones that transmit handwritten graphics, TV picturephones, videoconferencing, and Captain videotex.

TEST AND MEASUREMENT

Digitalization, optoelectronics are influencing instrumentation

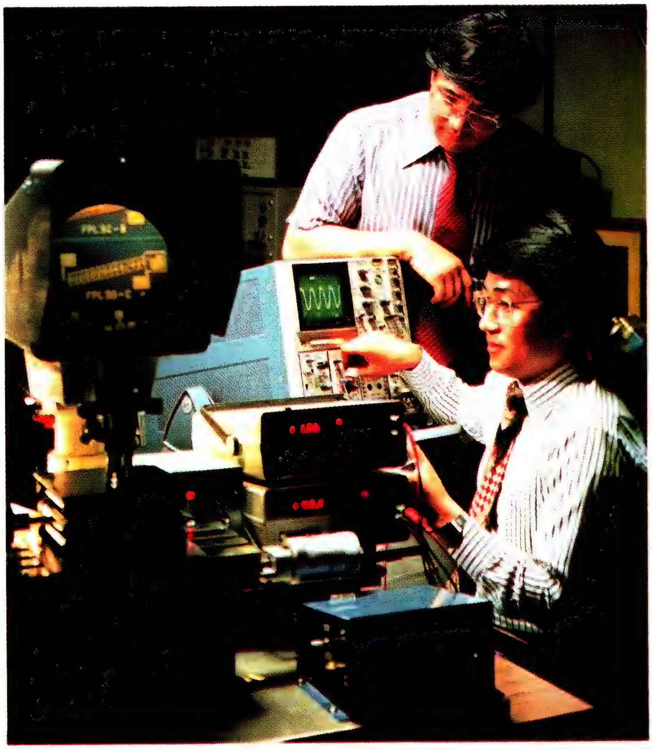
by Masakazu Kimura

Japan's production of test and measurement equipment, totaling some 76 billion yen in 1976, has been growing at an average annual rate of 15.7%, exceeding 200 billion yen in 1983. Especially remarkable growth was achieved by spectrum analyzers, wavelength analyzers (logic analyzers, microcomputer development systems, and so on), and integrated-circuit production test equipment.

The course of market demand and of technological development in the T&M industry is to a great degree controlled by changes in the industries that use electronic instrumentation. In the first place, the spreading digitalization of electronic instrumentation in general can be cited as one of the trends influencing the T&M industry.

Most notable in this regard is digitalization in the communications field, leading to intensified development of network analyzers, protocol analyzers, and other such

Sophisticated test and measurement gear is making possible advanced research at the Fujistu Laboratories Ltd.



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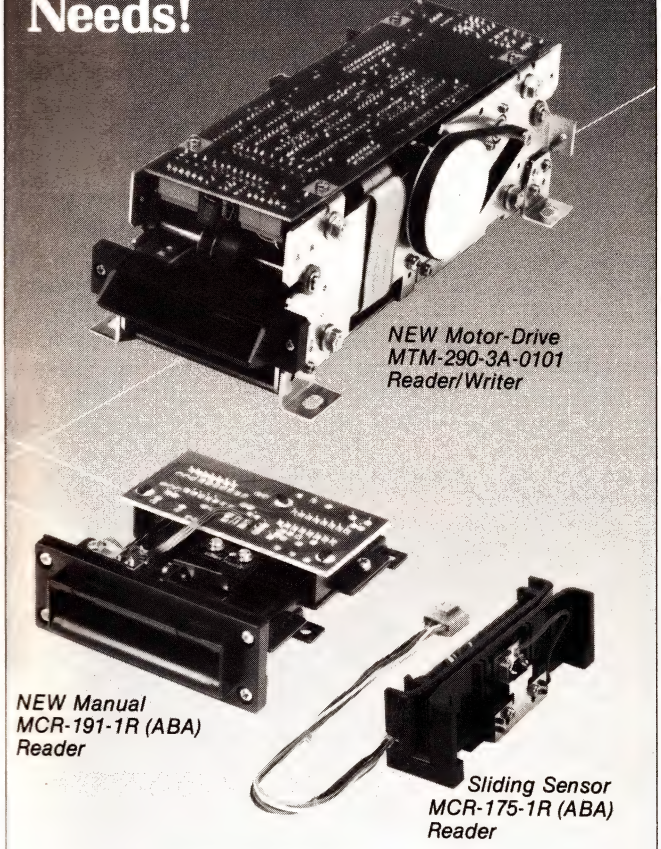

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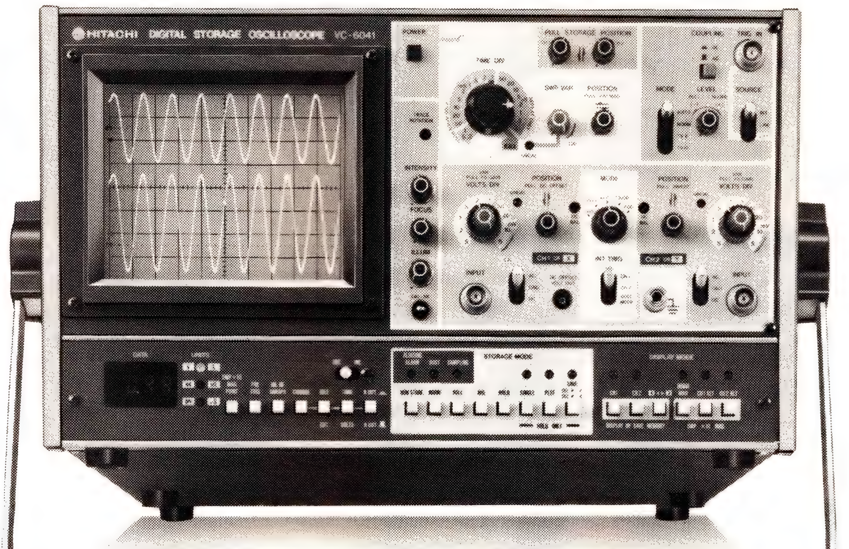
Other Features
● Two save memories enable waveform comparisons. ● Convenient roll mode for use in observation of low-speed events. ● Cursor function ● Averaging function. ● Pre-triggering ● Ground reference ● Convenient X-Y operation mode enables measurement of the phase difference between two waveforms. ● Stored waveforms may be recorded using a chart or X-Y recorder. ● Digital output of stored waveform values is possible using GP-IB. ● DC Offset function ● DC Offset voltage and frequency-reading outputs ● Vertical mode triggering ● High accuracy: ±3% ● Autofocus circuit and scale illumination ● Highly stable, low-drift design ● 8 Divisions of dynamic range ● High sensitivity: 1mV/div ● Large, 6-inch rectangular CRT with internal graduations ● Specially provided TV sync-separation circuit ● Built-in signal-delay line



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equipment. In addition, the digitalization of consumer electronics equipment, such as audio systems and TV sets, has exerted a great impact, in that this equipment carries great weight within Japanese electronics production.

Production of logic analyzers, microcomputer-related equipment, and other such digital-related products has being increasing dramatically, and it is likely that this growth will accelerate due to the expansion of the demand for digital consumer electronics gear. At the same time, it is likely that the manufacturers of industrial products will be looking for new kinds of T&M equipment.

A second trend influencing the T&M industry is the rise of optoelectronics. Up to this time, production of optics-related T&M equipment in Japan was mainly directed to the optical communications network being set up by the Nippon Telegraph & Telephone Public Corp. The scale of this production was small, and the number of manufacturers engaged in it was limited, consisting primarily of Anritsu and Ando.

In the coming years, however, it is anticipated that optical communications will expand from the field of long-distance communications into the medium and short-distance fields (optical local networks and so on), as well as appearing in electronic instrumentation itself. As such, indications are that optics-related T&M equipment will experience a dramatic production increase.

Optoelectronics Attracts

Accompanying this trend, it is likely that all of the present T&M equipment manufacturers will embark upon production in this field. In particular, the expanded application of optical technology to instrumentation is expected to have considerable impact, not merely in the sense of an increase in demand, but also in the sense that it

CORPORATE STRATEGIES

Masayasu Kawai, president
Kyowa Electronic Instruments Co.
Kyowa Dengyo Corp.

The human nervous system amounts to only 1% or thereabouts of the body's weight, but it controls all phases of its action. That is, man receives, through his five senses, various signals from the world around him that are sent to and processed by the brain which, in turn, puts out a command. This same process is seen in an industrial measurement and data analysis system, where a computer is the brain and the sensors are the five important senses. This measurement and information processing has continued to be the keystone in the development of science and technology, with more important roles forthcoming.

Today's industrial measurement is confronted with rapidly developing technological innovation in electronics. A succession of new elements continues to be created, including the super large-scale integrated circuit, laser beams, and optical fibers. This is ample evidence that we are well into the age of new elements.

These elements will no doubt find use throughout all future measuring equipment and systems, putting us at the threshold of the age of new-element dispersion. In this stage, new elements will play their most important role in sensors. This could very well give rise to expectations of intelligent sensors with information-processing ability, thus ushering in the age of compound sensors.

Forecasting these developments, today's measuring instruments are undergoing a dynamic change from analog to digital capability. Because digitialization facilitates data inputting to a central processing unit, which performs some functions similar to the human brain, its adoption will naturally accelerate.

While the human brain accounts for about 3% of total body weight, measuring equipment, which corresponds to the brain and nerves, has grown from approximately 1% to 1.5% in terms of sales in the machinery industry, and it may very well amount to 4% in the future. In this transition from analog to digital, we at Kyowa are also putting impetus on digitalization while preserving analog accomplishments.

Inasmuch as measuring technology corresponds to the human nervous system, it is natural that this technology play a crucial role in all disciplines of industry. And electronics, today's vehicle for measurement information, will be replaced by light in days to come. Such an advancement will only be possible by making the most of digital technology. Data transmission and processing have only recently been introduced to the awesome potential of optoelectronics. Kyowa is now ideally positioned to put the union to its greatest advantage in the measuring field.

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holds the possibility of completely altering T&M technology.

The third major influence on T&M equipment is the growth of production automation in the instrumentation and components industries. This will ensure a continued expansion of the production of component testing equipment, board testers, and system testers. An especially healthy growth is anticipated for component test equipment, powered by the continued smooth expansion of the country's semiconductor production.

Japan's achievements in T&M equipment is thus progressing around the three axes of adaption to digitalization, optics, and automation. A common theme for T&M gear of all kinds is an intensification of movement to upgrade basic performance, as illustrated by high-speed IC testers and broadband osciloscopes. A parallel trend is the movement to add on features designed, for example, to automate operation through the incorporation of microprocessors or to display additional information.

Oscilloscopes constitute the largest sector of T&M equipment. Recently, however, their production has expanded at a pace slower than T&M equipment as a whole. This is due to such factors as the on-going shift to spectrum analyzers capable of operating at a higher speed for a portion of the tasks previously entrusted to oscilloscopes and to the decline in the use of scopes, relative to

CORPORATE STRATEGIES

Shunichi Oshiro, president
Ando Electric Co.

Ando Electric Co. has engaged in the technology-intensive business since its founding in 1933. This business centers around the manufacture of a wide range of products, such as automatic test equipment and electronic measuring instruments for high-technology applications including very large-scale integrated circuits, fiber optics, and digital communications. Rapid technological innovations and the resultant fierce competition characterize this field, requiring a far-sighted vision both in research and development activities and in management.

I myself belive that where a politician should have a 50-year vision, a business manager should have a 25-year one. We should conduct business based on a 25-year plan, while at the same time heeding immediate needs and responding to changes as they come with our own contingency plans for specific business situations.

Ando's business achievements have steadily grown. Our midterm management program for 1981 to 1985, which has entered its second phase, has yielded better results than expected. For fiscal year 1985 we anticipate total sales of 42 billion yen ($138 million).

Our basic policy on technology development has remained unchanged, and that is to develop new products that meet the needs of the market head on and to promote the development of advanced electronic technologies such as microelectronics and optoelectronics.

As for our basic management policy, in 1981 we adopted a policy calling for quick response to changes; in 1982 we opted for enlargement of business from the international point of view and enhancing quality to realize this; in 1983, our cry was to curb rising costs thoroughly. Thanks to these efforts, the past four years' average sales growth rate has been around 26%. This year we hope to achieve 33% growth with our basic management policy of high growth with self-sufficient organization.

Ando's main products have consistently gained a good reputation in overseas markets. Thus, in addition to our liaison offices in California and Amsterdam, we will be opening a new liaison office in the eastern part of the U.S. this fall. We also plan to set up a liaison office in southeast Asia. This expansion of our sales network will enable us to maximize the efficiency of our sales activities.

We have likewise increased our presence in overseas exhibitions every year. In October 1983, we introduced our measurement instruments for optical-fiber communications at Telecom 83 in Switzerland. In May 1984, we exhibited and introduced our VLSI test systems at Semicon West. The ratio of exports to our total sales in fiscal year 1983 was about 13%. We aim to increase this to 20%.

"Ando with technology and vitality," the corporate slogan we introduced in 1983, our 50th anniversary, marks our present approach to business. Our ultimate goal is to evolve a management system mindful of consumer needs, offering high technology and high-quality products and services in the spirit of good will and cooperation.

logic analyzers and MDS equipment, due to the advance of digitalization.

Nevertheless, industry circles forecast a comparatively bright future for oscilloscopes. This outlook rests primarily upon the anticipated increase in the demand for broadband scopes. In short, the conversion to high-speed broadband ICs has been moving ahead over the whole of electronics instrumentation. Moreover, this should gain greater momentum through the practical utilization of gallium arsenide ICs and the rise of optoelectronics. This expansion in electronic instrumentation in turn would power an increase in the demand for scopes in the gigahertz-band range.

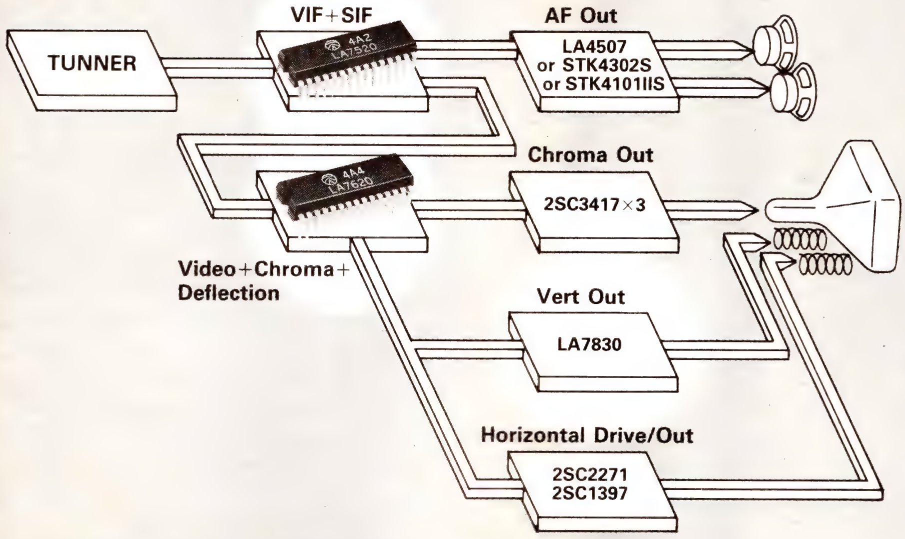
A second factor in the bright outlook for oscilloscopes is the increased demand for digital scopes. Although such market needs existed in the past, only recently has the possibility of a high-speed digital storage scope emerged, owing to the appearance of commercially manufactured high-speed analog-to-digital converters.

Scope R&D on Upswing

Thus far, Japan's oscilloscope manufacturers have put efforts into developing additional features and reducing costs as far as possible. In this new environment, however, they have begun to bolster their research and development activities directed toward improvement of basic performance. Their goals revolve around broadening the band range and increasing the speed of the operation.

The work on scopes with liquid-crystal displays, on the other hand, has not yielded products to match the substantial R&D activity, even in a worldwide context. Many of Japan's leading manufacturers are engaged in the development of LCD scopes, but as things now stand, all of them are finding it difficult to zero in on a product concept. However, certain new Japanese high-tech ventures are scheduled to unveil such products in the latter part of this year.

The practical utilization of LCD scopes holds great significance. In the first place, the scope market would be expanded, due to the the substantial reductions in size and and weight provided by LCD technology. This would mean not only increased utilization of scopes in field maintenance, but also the possible evolution of new applications: consumer use in the form of health management instrumentation, for example.



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Basic Specifications of Multi-Color Liquid Crystal Display Modules

Item / Model	Number of Pixels	Total Number of Dots	Display Area (mm)	Outside Dimensions (L × W × T, mm)	Display Color	Back Light
FT1616	160 × 64	480 × 64	105.6 × 42.2	170 × 100 × 25max.	8colors (Blue,Green,Red,Black, Cyan,Purple,Yellow,White)	Fluorescent Lamp
● FB2416	240 × 64	480 × 64	158 × 42	230 × 100 × 25max.	4colors (Green,Red,Black,Yellow)	Fluorescent Lamp
● FT2416	240 × 64	720 × 64	158 × 42	230 × 100 × 25max.	8colors (Blue,Green,Red,Black, Cyan,Purple,Yellow,White)	Fluorescent Lamp

● **FB2416** and **FT2416** will be available soon.

* Specifications subject to change without notice.

Basic Specifications of Dot Matrix Liquid Crystal Display Modules

Item / Model	Outside Dimensions (L × W × T, mm)	Viewing Area (mm)	Number of Display Characters	Character Size (mm)	Power Supply Voltage	Interface Format
M3212	186 × 32.8 × 9.4	147.4 × 16	32 Characters × 2 Lines	2.9 × 4.1	5.0, −5.0 *	Parallel
M3214	210 × 80 × 12.1	152 × 40	32 Characters × 4 Lines	3.50 × 5.15	6.5	Serial
M4012	186 × 32.8 × 9.4	147.4 × 16	40 Characters × 2 Lines	2.65 × 3.75	5.0, −5.0 *	Parallel
F1632	210 × 80 × 12.1	152 × 40	Full Dots	Full Dots	6.5	Serial
F2416	220 × 80 × 12.7	160 × 53	Full Dots	Full Dots	5.0 * *	—
F4816	270 × 70 × 12.7	225 × 44	Full Dots	Full Dots	5.0 * *	—
F481C	290 × 110 × 12.9	225 × 74	Full Dots	Full Dots	5.0 * *	—

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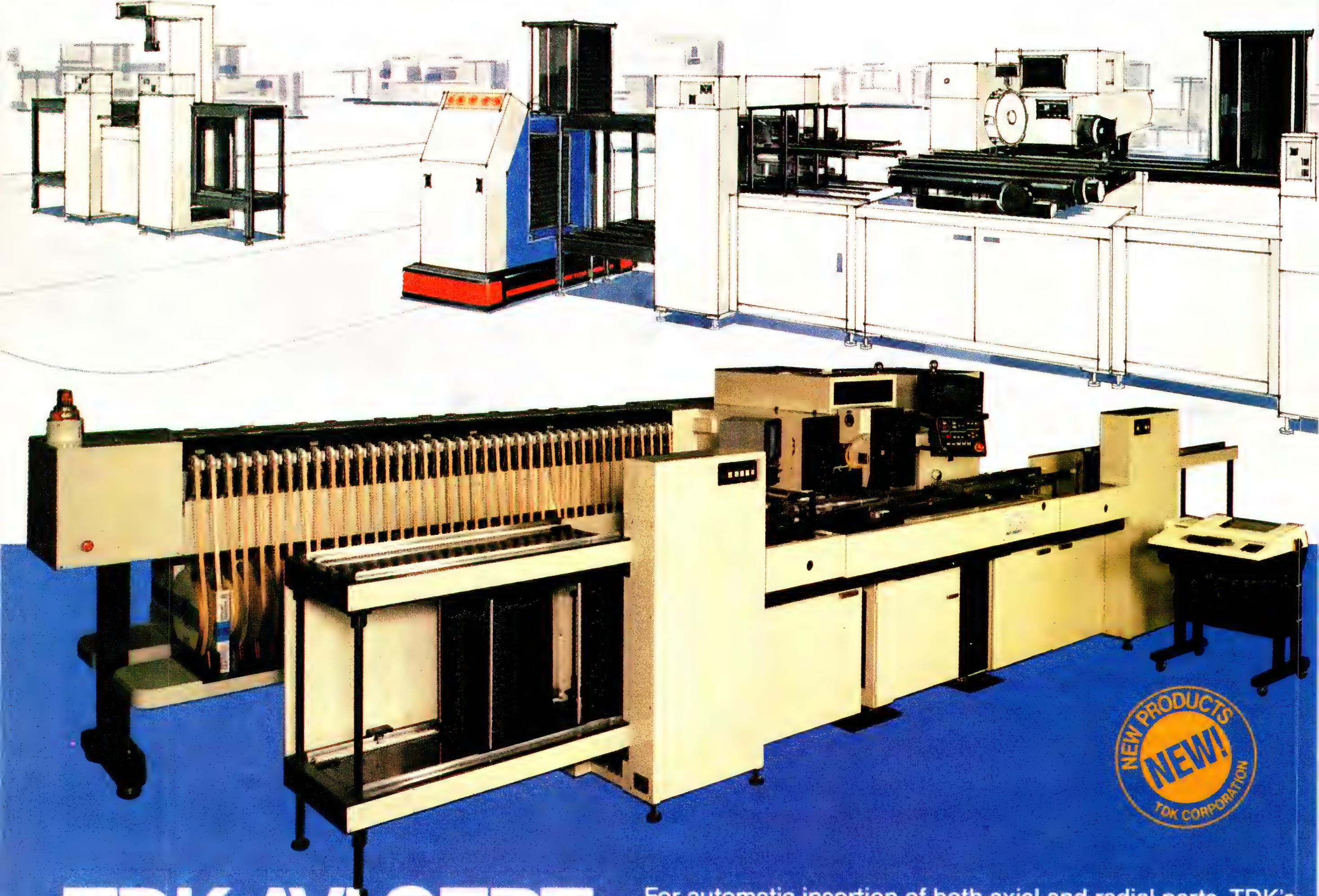

TDK AVI-SERT VC-5080AR

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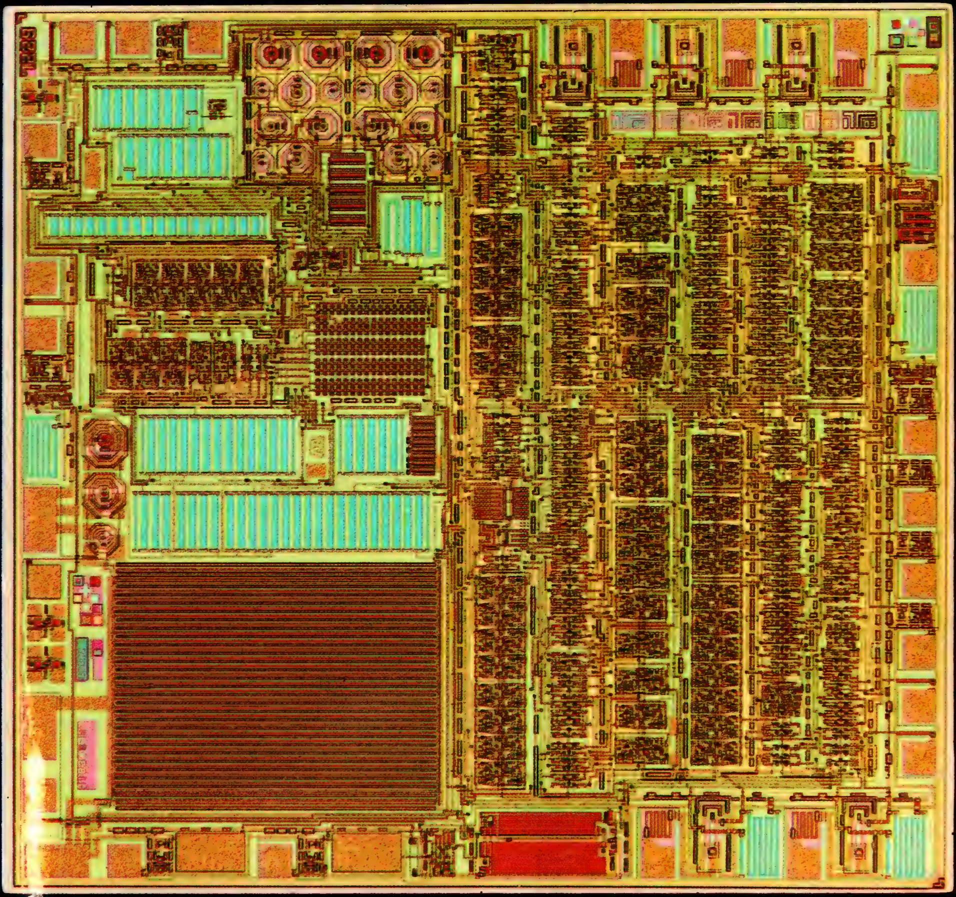

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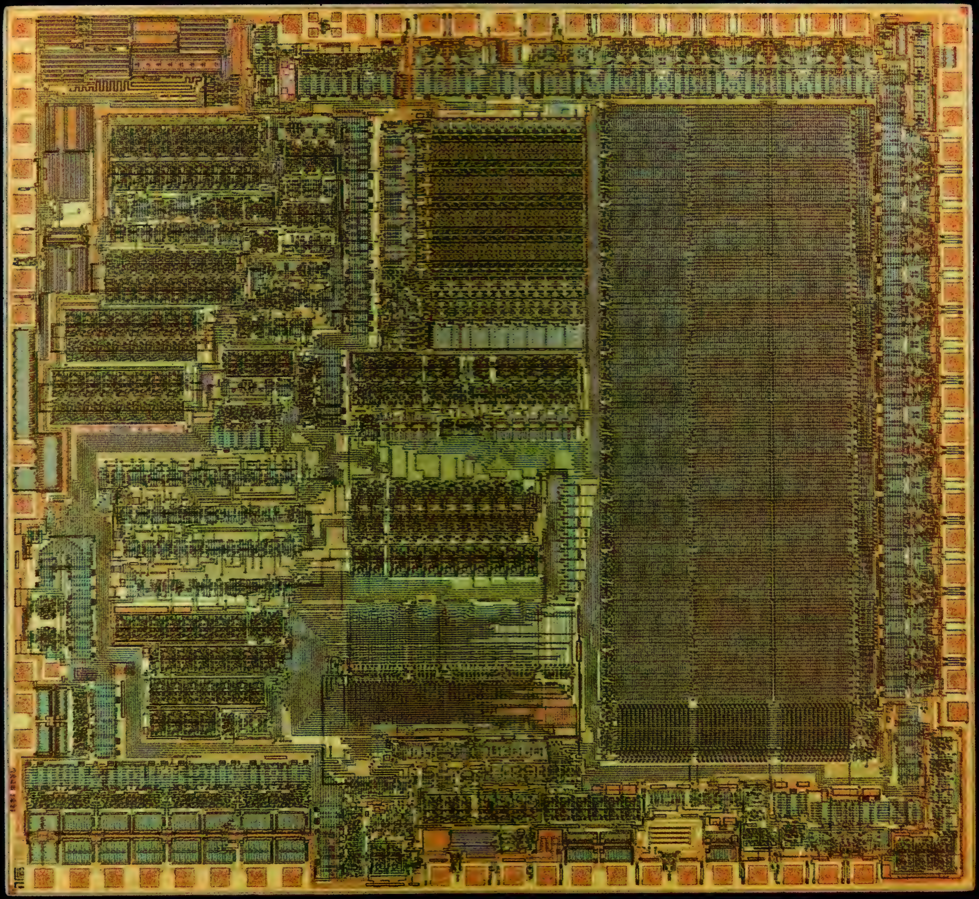

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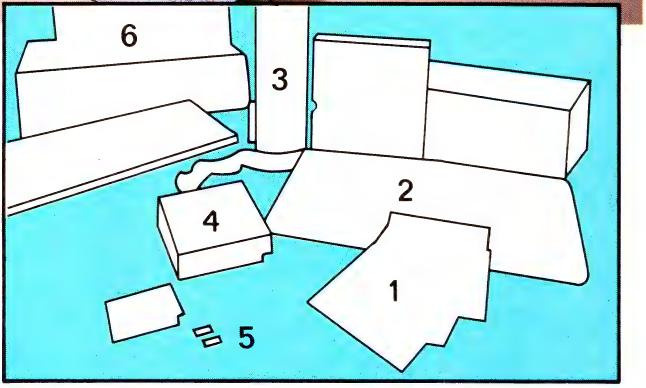

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SPECIAL REPORTS

ICs TAILORED TO APPLICATIONS GAIN GROUND

Gate arrays, full-custom designs find new favor for application-specific ICs, but in the future the standard-cell approach will dominate

☐ *by Bruce R. Bourbon*

Today's demand for application-specific integrated circuits—gate arrays, standard cells, and full custom—and the heavy attention being given this segment of the semiconductor industry is not just a passing fancy. Nor is it a reaction to a shortage of standard parts that will fade as capacity grows to meet demand. The explosive growth in the custom and semicustom markets is testimony to major changes in the IC industry. Recent advances are driving a movement toward custom ICs that not only will force its continued growth but cause it to dominate and change IC technology as we have always known it.

At the most general level is the obvious driving force of competition. In the design of electronic systems, the competitive need to develop new products and improve old ones is a continuing battle. This battle has spurred the development of IC technology to provide the means for adding product features and increasing reliability while reducing the size, power consumption, and cost of

Floor plan. The advent of computer-aided design techniques and CAD work stations has placed complex chip design capabilities, like this computer-generated chip layout, in the hands of relatively untrained system designers.

the product. The semiconductor industry has met and exceeded the demands of systems manufacturers in providing the technology to remain competitive and advance product offerings, while creating ever-larger markets. But the number of IC design engineers who can create designs in silicon has not grown. In fact, it has been estimated that there are only about 3,000 IC designers in this country at this time.

Influencing factors

This limited supply of competent design engineers, along with the lack of software to aid in the design process, had been the main factor in encouraging the use of standard ICs and had impeded the use of custom ICs in electronic systems. Standard products such as memories, logic chips, and microprocessors are used in designs because of their off-the-shelf availability and clearly defined behavior and performance: systems designers can just use a combination of these products on a board to achieve many of their product goals. Now, however, the situation has changed: the capability of IC manufacturers to pack more circuitry on a chip and other changes will lead systems designers to rely on application-specific chips for their competitive edge.

Three factors in particular have conditioned the market to turn to application-specific ICs as a solution. Much credit goes to the hierarchical design technique that was first advanced by Carver Mead and Lynn Conway at the California Institute of Technology [*Electronics,* Oct. 20, 1981, p. 102] and later at other universities. Inherent within the Mead-Conway technique was the philosophy that systems designers should be trained to design ICs.

Although computer-aided design tools to support the Mead-Conway technique have not yet become generally available, university training has resulted in a reduction of the perceived barriers to IC design. Hardware and software companies, fueled by an abundant supply of venture capital in the 1970s, have attacked the problems of providing low-cost CAD tools to design engineers themselves. Now the tools are friendly enough for systems designers, so any perceived barriers have dropped away.

This change has occurred simultaneously with advances in process technology to a point where gate arrays and standard cell equivalents having up to 10,000 gates can be fabricated. The synergy of design training, CAD developments, and process improvements thus has created the explosive growth of application-specific ICs and will continue to fuel their rise to a major means of chip development.

Gate arrays will initially benefit more from the improved CAD tools because they have a fixed physical structure, so it is easier to place and route logic elements automatically in creating the mask data for manufacturing. In redesigning a system to achieve higher levels of integration, a rule of thumb is that 80% of the system typically can be realized with gate arrays. Another point in gate arrays' favor is that they will always have relatively few numbers of layers to personalize, with the attendant advantage of lower tooling costs.

Another advantage is in the area of component qualification. If a large manufacturer has a significant component qualification requirement, it can typically qualify the gate arrays once and not have to requalify each pattern on the chip. This contrasts with standard cells, where each circuit is different and must be qualified individually.

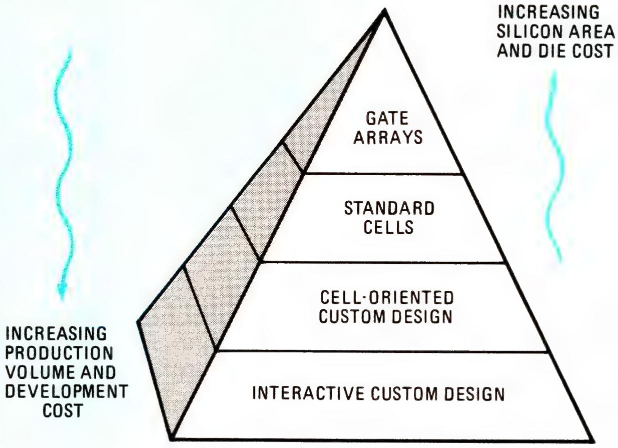
Gate arrays will continue to serve in lower-volume applications where their lower development costs more than offset higher unit prices. Arrays' advantages include the lowest development time and cost, fast ramp-up of custom manufacturing and easy entry into the custom market, due to the relative ease of design. Gate arrays are often used for breadboards to prove systems concepts, since the engineering development time is short and costs are low.

Because the macrocells are already characterized and proven, circuit and logic simulation are greatly simplified. And since wafers can be stored in an unpersonalized condition, the time to production is generally three to four weeks shorter than for full-custom chips. This results in lower inventory levels at the supplier, as well as gives the systems manufacturer greater capability in coping with peak load conditions.

Standard cells will dominate

Nevertheless, an ongoing migration from gate arrays to standard cells indicates that the latter will become the dominant form of application-specific ICs. Standard cells not only can provide higher density and lower-cost parts—they also can provide precision analog functions on chip, which results in broader application to the solutions of system circuit problems.

In the future, the major cost difference between standard cells and gate arrays will be the cost of the additional manufacturing tooling for standard-cell circuits, since all levels of standard cells must be personalized and extra time is needed for the fabrication of standard-cell circuit wafers. Even this cost may disappear if electron-


INCREASING SILICON AREA AND DIE COST
GATE ARRAYS
STANDARD CELLS
CELL-ORIENTED CUSTOM DESIGN
INTERACTIVE CUSTOM DESIGN
INCREASING PRODUCTION VOLUME AND DEVELOPMENT COST

1. Continuum. There are no clear-cut lines that mark the optimum process for implementing application-specific ICs. Each design has unique parameters that determine which of the available options can produce the most cost-effective solution.

beam direct writing is eventually used for image creation, rather than optically prepared photomasks that are the accepted technique now.

Customized standard cells generally use rows of fixed-height and variable-width cells, with variable-width wiring channels between rows. Power supplies are automatically connected when cells are abutted. Typically, standard-cell parts are considerably denser than gate arrays but generally are 40% greater in silicon area than an equivalent full-custom chip. Like gate arrays of logic macrocells, these cells are also well characterized and simulated.

Full-custom ICs offer performance advantages over gate arrays and standard cells by drawing on all the features and flexibility inherent in a given process technology. Custom chip design is best for high-volume applications (more than 50,000 parts) because it results in the minimum die size. The resultant lower unit prices offset the inherently higher development costs. In some large complex designs, in fact, full-custom chips may be the only choice.

With a typical complementary-MOS chip of 1,000 gates, arrays provide the most cost-effective approach for up to 20,000 parts; beyond this point standard-cell designs yield the lowest cost (See "Choosing a custom solution based on cost," below.) Around 50,000 units, the higher development costs of a full-custom design are amortized over a large enough volume so that such ICs become the most cost-effective alternative .

This is not to imply, however, that there are clear-cut lines of differentiation between the approaches. The custom market is, in fact, a continuum in which each design has different parameters that determine the optimum solution (Fig. 1).

The current overall emphasis on gate arrays and standard cells will further legitimize full-custom solutions, fulfilling the market expectations for shorter up-front costs and shorter production cycles. High-volume customers will move toward full-custom designs for cost reduction and performance improvements as internal design centers, CAD software tools, and work stations become more prevalent in the design community.

A look at the market

The total market for application-specific ICs (including gate arrays, programmable logic arrays, standard-cell designs, and full-custom chips) should grow from $3.8 billion in 1983 to $13.7 billion in 1989 for a 24% compounded annual growth rate (CAGR). More impressively, merchant suppliers' share of this market should grow from 42% of the market in 1983 to 57% by 1989, growing by a CAGR of about 30%. This represents a market share of $1.6 billion in 1983, swelling to $7.8 billion in 1989.

Such extraordinary growth will be reflected in each segment of the application-specific IC market: MOS gate arrays will go from a modest $153 million in 1983 to just over $1 billion in 1989, for a 38% CAGR. Standard-cell designs will undergo even more significant growth, however. Their share of this market will go from $43 million in 1983 to $1.2 billion in 1989, a CAGR of 72.1%. Full-custom designs will grow from $1.1 billion to $4.1 billion during the same time, for a 23.9% CAGR.

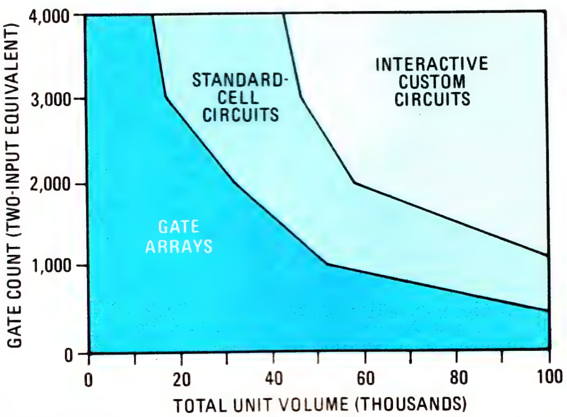
The MOS application-specific IC merchants will maintain 30% of the total market, growing from $1.3 billion in 1983 to $6.1 billion in 1989. Projections indicate that

Choosing a custom solution based on cost

Once the decision has been made to go the route of application-specific integrated circuits, the next step is selecting among the various options—gate arrays, standard-cell circuits and interactive full-custom circuits. One of the major selection criteria is the effective unit cost of each design approach.

Because a standard-cell design uses silicon area more efficiently than gate arrays and because custom design is even more silicon-efficient than standard-cell design, the inherent unit prices of custom chips are lower than those of standard-cell ICs, whose prices are in turn lower than those of gate arrays. The development cost of a custom chip, however, is higher than that of a standard-cell chip, whose development cost is higher than that of a gate array.

To compare accurately the relative costs of gate-array, standard-cell, and custom parts, the development cost of each type of chip must be divided by the total production volume. This amortized development cost must be added to the price (which is a function of the production volume) in order to produce a realistic unit cost for comparison.



The accompanying graph uses these effective unit costs in order to create three zones that identify the most cost-effective design solution at a given volume and gate count. Because the importance of silicon area efficiency is magnified in larger circuits, the crossover point from one design technique to another occurs at lower volumes when gate counts go up.

It is worth noting that many factors, beside gate count and volume, can have an influence on the effective unit costs. Thus the total unit volume that is indicated at a given gate count may vary by up to 45% in either direction.

by the year 1990, 80% of the custom MOS manufacturing will be done in CMOS technology, primarily because of the system power-saving characteristics of this technology as well as because shrinking geometries are giving CMOS the high speeds that are required by the systems being made today.

Projecting the technology evolution over the same time period shows the number of active elements per chip increasing from the MSI range to very large-scale integration, with densities of more than 100,000 devices on a chip. In five years, the IC industry will usher in the era of ULSI (ultra large-scale integration) and will routinely place 1 million devices on a chip. This evolution means that manufacturers will be able to put entire systems on one chip before the end of the decade.

As this capability becomes a reality, end users gain the benefits of reduced cost, less space consumed by circuitry, and dramatically improved reliability because of reduced part count. But a concomitant challenge arises: packing more circuitry on a silicon chip produces a design that fits into fewer end applications. To design complicated VLSI and ULSI custom circuits requires either tens of man years of effort by scarce IC design engineers or new design approaches.

Led by sophisticated CAD hardware and software, these new design approaches are rapidly changing the design environment. But this is only an evolutionary step in what is really a revolution. This revolution, propelled by work stations, is moving the industry from computer-aided to computer-automated design. Systems designers will use advanced CAD tools to implement ideas into silicon in a fast, error-free way.

The rapid emergence and growth of the gate-array and standard-cell markets testify to the benefits of managing IC design complexity through semicustom design approaches, fully supported by CAD software. The effort to develop VLSI circuit-design tools, such as silicon compilers, is another indication that CAD has made IC design simpler for systems engineers.

The power of CAD

IC design has also been greatly simplified by techniques that automatically perform design-rule, continuity, and load checking, as well as flag problems. Since these tools will free designers from such mundane concerns, a greater level of creativity can be expected from systems designers. At the same time, most of today's circuit designers will be designing ever more complex and useful standard cells and macrocells to be used by the systems designers with their CAD tools. Even now, CAD has reduced nonrecurring engineering development costs by an order of magnitude, and continued automation will decrease development times for semicustom solutions to as little as two to three weeks.

Looking at the average 1980 development cycle, from design through prototype, of a 2,000-to-3,000-gate part, development time for an array design was 8 to 9 weeks, a standard-cell design required 12 to 16 weeks, and a full-custom design's development time ranged from 18 to 26 weeks. Today, this time difference is being reduced markedly. By 1990, moreover, as macrocell libraries become the data base for all three types of development, the length of the development cycle will depend more on design complexity than on design approach, and any difference in cycle time will be accounted for by wafer-fabrication time.

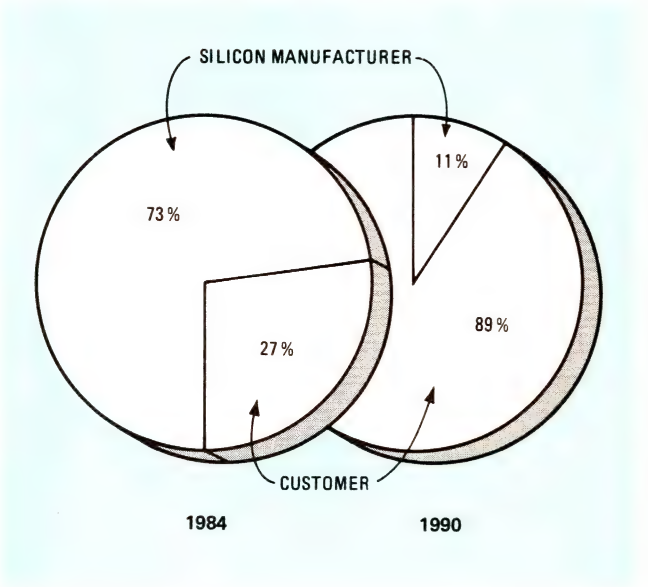
From a cost standpoint, in the future, practically the only difference between standard cells and gate arrays will be the cost of the additional masks required to personalize standard cells. Even this may disappear if electron-beam direct-writing becomes a practical alternative to today's optically prepared photomasks or stepper reticles.

Issues for the future

The growth rates and shortened production times that characterize the application-specific IC market have only been made possible by the availability of computer-aided and computer-automated design tools that reduce the cost, time, and risks of development by eliminating many of the labor-intensive tasks associated with every design step, from logic design, through breadboarding, to circuit layout. With the rapid improvement in, and proliferation of, CAD software, it is possible to project what further improvements in CAD technology may bring and what challenges remain.

From the standpoint of the IC vendor, CAD will continue to be widely used and will be continuously improved for use in complex chip design. But more than that, CAD will encompass the processing of data that will help automate the entire chip manufacturing process, including process description, test-pattern description and generation, and generating the tape that controls the packing and assembly of the parts.

In the future, the customer will also have a greater range of options with which to interact with the custom manufacturer. Depending upon the expertise of the systems house and the designer, the interface with the manufacturer can begin at any point, from the system description to the mask level. The designer can proceed to select from a catalog those functional building blocks



2. Who does what. By the end of the decade, responsibility for the design of application-specific ICs will shift primarily to the customer, as opposed to today's situation. Such a shift presupposes greater proliferation of CAD tools and wider access to design centers.

necessary to define a system and then provide the IC manufacturer with the input for automatic placement and routing in the form of a program generator tape, so the product can be manufactured in a very short cycle time.

Such a close relationship with customers will require IC manufacturers to develop effective means of postsales support. The idea of postsales support is important because of the rapidly growing need to support customers who are doing IC design. Manufacturers will also have to provide access to design centers for customers through distributor connections or captive design centers where customers can be trained and get applications support. This will require skilled software applications engineers who know how to use CAD tools and experienced logic design application engineers who will focus on how to do IC design (Fig. 2). This means that manufacturers will have to train a customer's design engineers to handle gate arrays and standard cells as well as in the use of work stations and cell libraries.

Distributors have an existing established customer base and, if they are competent in offering design center services, their customer base will turn to them for gate-array and standard-cell design support. Also, with an existing sales force calling on customers, they would have a natural marketing tool in their design shops. Their challenge, however, will be attracting and holding logic design engineers in what is primarily a sales organization. It is still an open question if they can succeed in switching from a sales-from-inventory operation to a high-technology service area.

For standard-product manufacturers who enter the application-specific market, there will also be challenges. They must make the transition from marketing a relatively few products in high volume to running a wider variety of products in smaller quantities. From a design standpoint, the vendor must shift from complete control of the design to providing customers with the tools to do their own designs.

The custom manufacturer holds the advantage where a large product mix requires extensive setup modifications of numerous pieces of equipment. One key area is photolithography, where masks or reticles may need to change as frequently as every run of 50 wafers. Typically, for a given number of wafers, a custom manufacturer will use 100 to 1,000 times more masks or reticles than a standard-product manufacturer.

Perhaps the most challenging problem created by the proliferation of software design tools and advancements in technology, however, is in the area of testing. Software and circuit designers who have learned to deal with CAD will have to master the techniques of computer-aided testing as well. The traditional techniques for generating test patterns—whether by manual development, fault simulation, or automatic test-program generation—become increasingly difficult and more expensive as circuit complexity increases. This is creating a strong trend toward designing testability into the chip along with self-testing circuitry.

Various forms of the scan path test technique developed by IBM Corp. are the basis of most approaches for implementing testable designs because they lend themselves particularly well to the testing of today's highly sequential circuits. Unfortunately, both self-scanning and on-chip test circuitry impose penalties in additional silicon area, which the industry will have to accept.

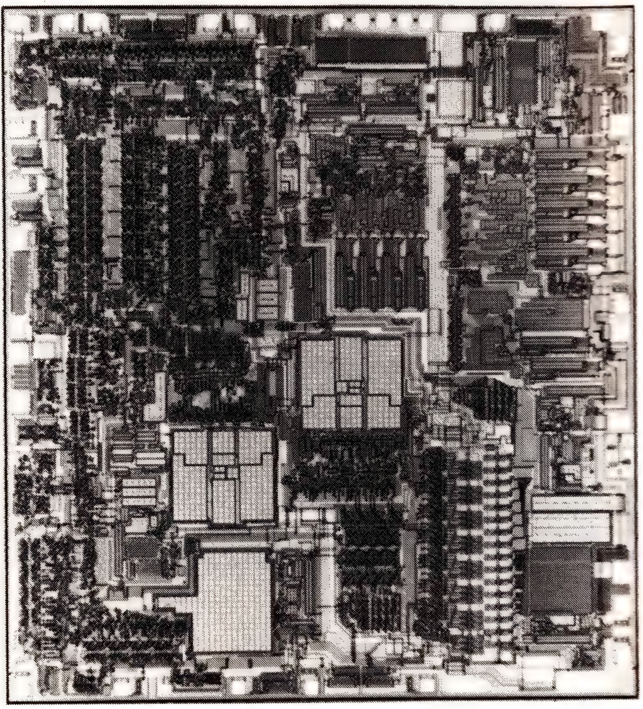
Another key development area is advanced processing. In the past, custom and semicustom ICs tended to utilize conservative, well-proven processes lagging the state-of-the-art. This was a deliberate policy, since an unproven process used on an unproven design could jeopardize achievement of a custom application. Now, with the advent of CAD, semicustom solutions can be developed much faster and with very little risk. Advanced processing techniques can be utilized in the design, which can be proved out by simulation techniques.

CMOS is king

CMOS silicon-gate technology will dominate the application-IC area, with 1-μm geometries common by 1986. Electron beams will be universally used to make perfect masks and reticles in minimum development time. High-pin count packages will accommodate the increasing system complexity of the future.

The strong continued growth of application-specific ICs is clear, as is the direction of IC technology. These changes constitute a major cultural transition for the semiconductor industry and its customers. But to the semiconductor industry, change is a way of life. It has always met challenges imposed by changes in the market and the technology, and it is certain to exhibit the same kind of successful response to the changes imposed by the era of application-specific ICs. ☐

Bruce R. Bourbon is vice president of the semicustom group of Gould AMI Semiconductors.



Shrinking cycle. Today, development cycle times, from design through prototype, for full-custom circuits like this telecommunication chip range from 18 to 26 weeks. By 1990, these times will approach those of gate arrays and standard cells for equivalent designs.

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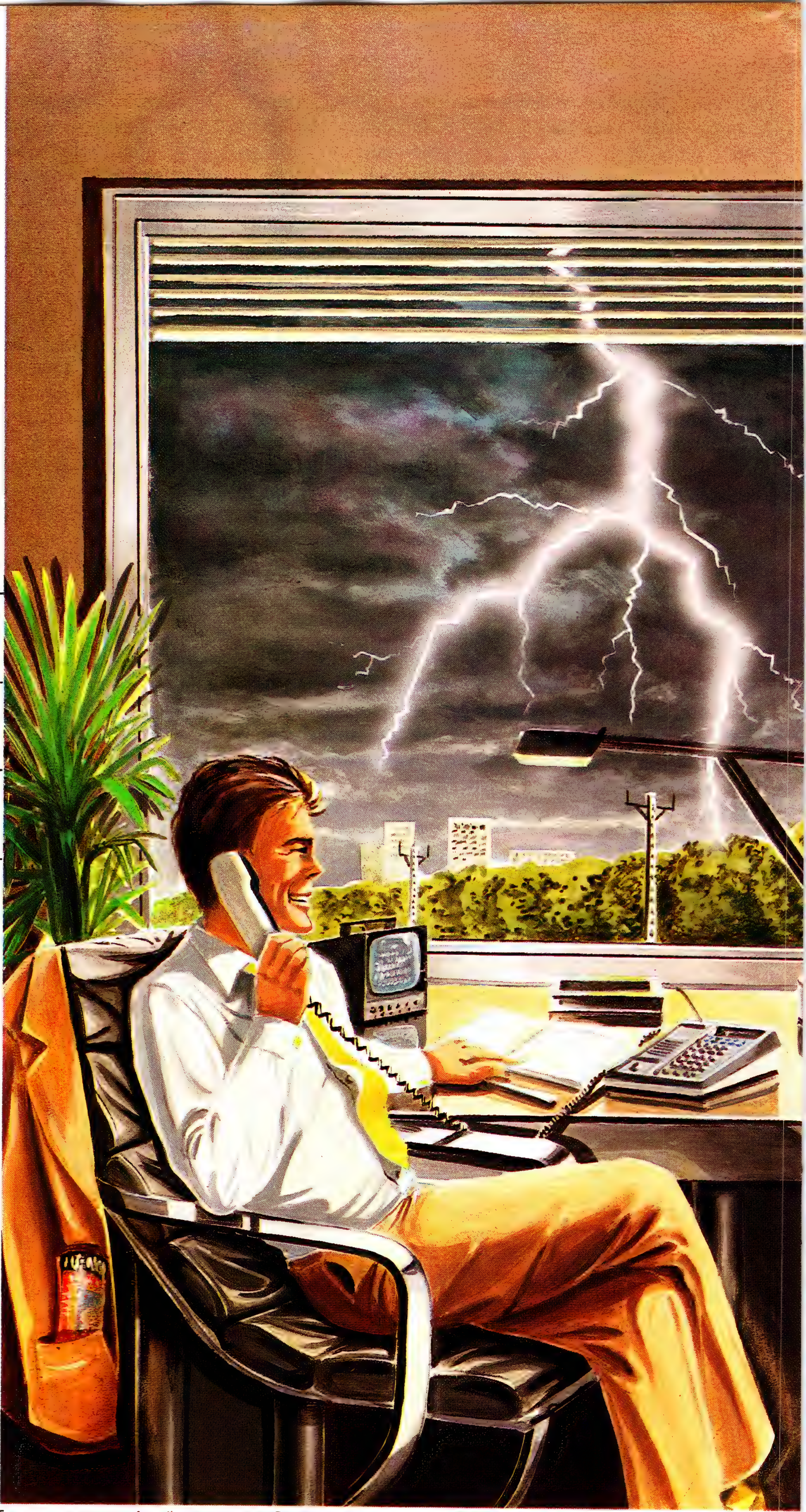

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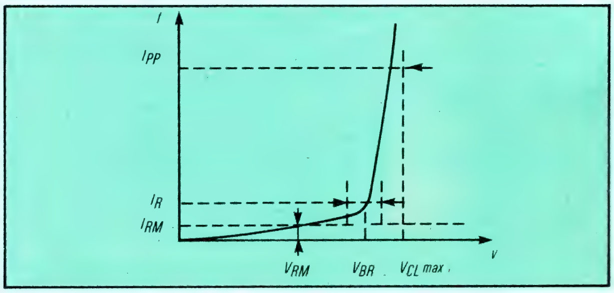

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TRISIL

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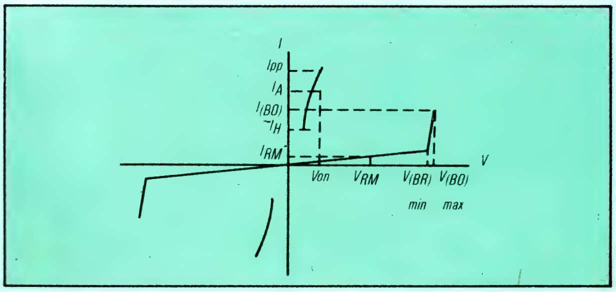
MAIN ELECTRICAL CHARACTERISTICS

- *The peak reverse voltage* V_{RM} *is the voltage which the TRISIL can withstand in continuous operation with typical current* I_{RM} *of 5nA.*
- *The breakover voltage* V_{BO} *is the maximum voltage which the equipment to be protected will withstand. It is the breakover point from ON to OFF.*
- *Overload possibilities: these are only defined in the on-state. They permit the absorption of short transitory current (Ipp 8.20 μs) or high RMS currents (*I_{TSM} *30 or 50 Arms/20 ms).*
- *The holding current* I_H *is that below which the TRISIL returns to the off position (*V_{RM} *-* I_{RM}*).*



APPLICATIONS

TRISIL is designed to protect electronic sub-assemblies or low power components. The actual range covers a wide voltage range, V_{BO}*, from 100 V to 300 V and holding currents of 120 mA and 180 mA. The precision of its triggering threshold and its small overall dimension allows it to be used for all vulnerable points of a system, particularly each time there is a connection with the outside world.*

In telephony, TRISIL ensures the protection of telephones or any other equipment (modem - teleprinter) connected to a telephone line, against overvoltages from atmospheric origin or produced by accidental coupling with the mains.

THE RANGE

Type	V_{RM} *(V)*	*Ipp (A) 1 ms expo*	I_{TSM} *(A) t = 20 ms*	*Case*
TPA 100A-12 or 18 *TPA 270B-12 or 18*↓	*90 to 243*	*50*	*30*	*F 126*
TPB 100A-12 or 18 *TPB 270B-12 or 18*↓	*90 to 243*	*100*	*50*	*CB 429*

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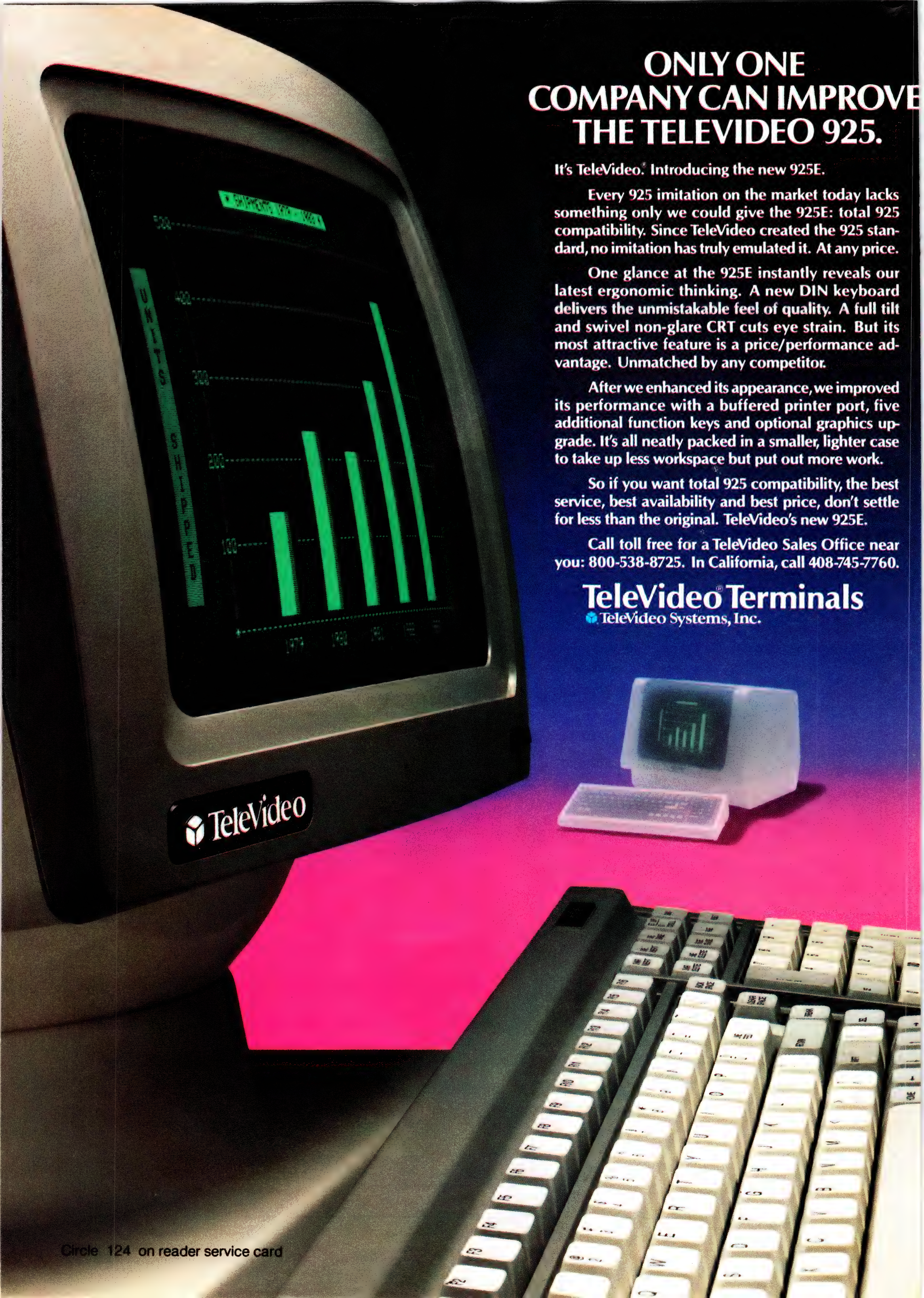

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MATCHING THE ROBOT TO THE JOB

Certain considerations figure in the choosing of any of today's modern robots; among them are payload analysis and programming requirements ☐ *by Graeme Kinsey*

Robots are entering every phase of the manufacturing process from assembly to testing. In many applications, they are taking over mundane and dangerous tasks, providing cost-effective increases in manufacturing production volumes and freeing people for more creative enterprises.

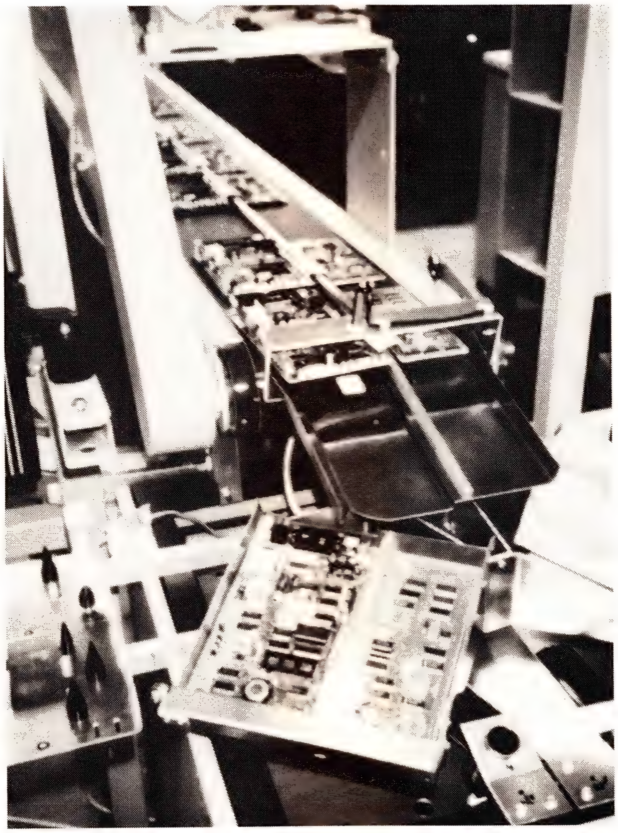
For an ever-increasing number of applications, today's generation of robots, offering improved accuracy and intelligence, is giving even inexperienced manufacturing managers a competitive edge. Even those unfamiliar with robotics and factory automation are able to submit production needs to analysis, select the appropriate units, and move down the robotics learning curve quite quickly.

The best approach to selecting a robot is to use a step-by-step process, analyzing the task, environment, and machine capabilities. A list of robot selection criteria includes:

- Payload analysis.
- Positioning requirements.
- Programming efficiency.
- Work-envelope definition.
- Machine speed.
- Maintenance considerations.
- Vision capabilities.

Before selection, a manufacturing manager must fully investigate all tasks that the robot will perform. He or she must also understand what portion of the production line needs to be automated. In addition, the potential user has to determine whether it is best to keep the automated portion of the line independent of other existing production systems, or if it is better to integrate the robot into other established automation systems in the factory.

For instance, if the entire production line is to be automated—making it necessary for each automation stage to work along with the next stage—the line must have a balanced work load. If, for example, one stage of a production line is to employ a system capable of supporting hundreds of products per hour and the next stage can support only half that amount, the line is not in balance.



1. **Working together.** Synchronization of a production line conveyer belt and a robot is necessary to ensure that the robot is not fed material until it is ready to perform its task.

If such a seemingly simple requirement is overlooked, or not properly analyzed, inefficiency on the production line will result. No production line is able to effectively support the use of a high-speed node (a work-station position) without either accelerating the rest of the line or spending a good deal of time waiting for parts or materials to be processed. This is also true when automating sections of a line while not automating others—creating islands of automation.

Once the tasks are investigated and the line is examined for the best possible balance, the manufacturing manager can apply the selection process. During the investigation, the selector must use cost/performance tradeoffs as the overall selection guide.

In addition to the requirements detailed previously, other application-spe-

A robotics lexicon

Anthropomorphic robot: A robot employing arms that make movements resembling those of a human arm (i.e., bending, reaching around corners).

Cartesian robot: A robot with motions resulting from movement along horizontal and vertical tracks, rather than through the use of joints—often called an **othogonal robot**.

Degrees of freedom: The number of coordinate axes around which or along which motion can occur. To have meaning, this number must include a definition of axes.

End effector: The hand (or gripper) of the robotic arm—the interface between the arm and the device it's acting on. It may or may not be a holding device; for example, it may be an electric screwdriver.

Footprint: The area and shape of the floor space required by the robot and its controller.

Payload: The mass that can be moved by the robot, given its specified performance in terms of accuracy, speed, repeatability, and the like. Larger payloads may sometimes be accommodated at reduced performance by the robot (slower speed, for example).

Pick-and-place robot: A limited-motion robot, with little control over its path, designed to move from one point to another. Generally used for transfering a part from one place to another, such as from one conveyor to another or from a parts bin to a location on an assembly line.

Repeatability: The positioning error—or more precisely, the relative accuracy of positioning—made when a point, previously located, is recalled.

Resolution: The distance between two adjacent points that can be distinguished from each other.

Robot: The Robot Institute of America defines robot as "a reprogrammable multifunctional manipulator designed to move material, parts, tools, or specialized devices through variable programmable motions for the performance of a variety of tasks."

Work envelope: The set of all points that may be accessed by the robot. This area varies with the end effector, which may increase or limit the set. All points may not have total freedom of all degrees of motion. For example, the highest point in the envelope may not be one that the robot can reach with its end effector pointing down.

cific parameters should be investigated. For instance, in some cases, repeatability—the robot's ability to return to a specified point during repetitive processes (see "A robotics lexicon," above)—may be important. Other application-specific examples include transportability of software (from one robot to another), payload, ease of programming, number and type of axes of motion, and the footprint (amount of floor space it occupies).

The selection process

At the top of the step-by-step selection process is payload analysis. The payload includes both the device being handled and the mechanism that will hold the device (called either the end effector or the gripper). To calculate the payload requirements, the first step is to examine the materials that the robot will be handling by determining size and weight boundaries (the maximum size and weight of a representative sample of the material or parts). The next task is to estimate the weight of the end effectors used to hold the materials. The sum of the two is the robot's payload requirement.

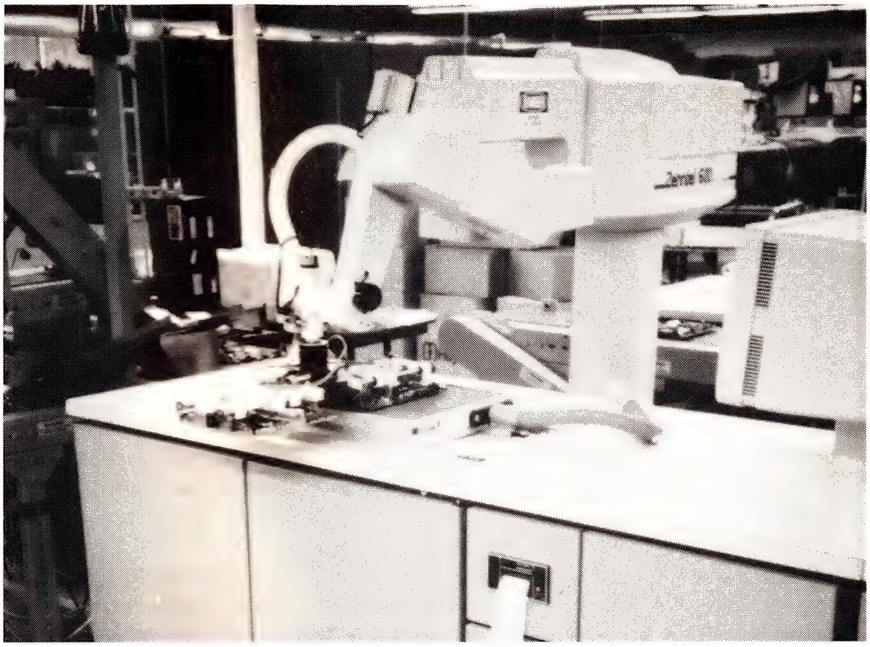
Because robot end effectors move from place to place, it is important to calculate the amount of positioning accuracy and repeatability needed. Accuracy can range from several hundredths of an inch for a simple robot to several thousandths of an inch for a robot doing precision assembly or handling small parts. For example, in the case of a robot used in the testing of printed-circuit boards, the end effector must get close enough to the board to pick it up and close enough to the fixture on the tester to place the board on it with sufficient alignment. Such an application could call for an accuracy of a few thousandths of an inch. A less accurate robot can perform adequately, but requires guides to direct the board onto the end effector. However, adding these extra features to a less accurate robot is usually more costly than purchasing a more expensive but more precise robot to begin with.

One of the most crucial aspects of today's robots is programmability. Insight into the programming efficiency of a particular robot can come from conversations with manufacturers who are currently programming and using the robot under consideration. A prospective user armed with this information can ask a vendor to show him how to create a motion-efficient program for the new application.

Some robots require programmers to learn an entirely new language. Others, using enhanced versions of languages, such as Basic, usually offer a shorter learning curve. Although they are often unfamiliar, there are unique languages well-optimized for robotic movements. These can actually be easier to use than more general languages, once they are mastered.

Another aspect of programmability is software transportability. It is becoming more common for large production lines to employ several robots of the same type. If programs are not transportable, users face debugging tasks, as well as the possibility of providing separate maintenance for each set of programs. One potential problem, however, is that making nontransportable programs work on each robot may require excessive modification. This could lead to higher than anticipated costs because, most often, program editing requires the expertise of a skilled programmer.

No degree of program transportability or any other capability can overcome the problems associated with a



2. Staying put. The physical placement of the robot must be considered in relation to its controller and tester or assembly table. Even a slight flexing of the robot's mounting surface may be intolerable for the assigned task.

robot that has been selected to operate in an incorrect or insufficient work envelope. The robot selected for a particular application must work within the envelope containing all equipment necessary to perform the task (see "Using existing nodes of automation," p. 128). Determining the work envelope, in fact, is the key to making the assessments of all other robot requirements. For that reason, extreme care must prevail when defining the work envelope.

Every point in space may be thought of in terms of six coordinates: a Cartesian coordinate defines the position of the robotic arm in terms of left-right, front-back, and up-down; three angular coordinates indicate its pitch, roll, and yaw. These coordinates must be tightly controlled for all of the components to mesh properly. This may come about through rigorous alignment of the node, through flexible manipulation of the robot, or through a combination of both.

No time wasted

Another calculation determines the speed requirement for the robot. Neither the robot nor the node should waste time waiting for the other, so typical test or assembly times should be estimated and compared with the cycle times of the robot under consideration (Fig. 1). Ensuring a balance between these times helps determine the best configuration for a specific use. No calculations are needed to determine a robot's suitability in terms of maintenance support. Common sense should certainly prevail here.

Before delving into system integration, robot vision should be reviewed. Although robot vision systems are being put to some innovative uses and in some cases have proven valuable in reducing mechanical guide costs, the technology of today's production vision systems is still not fully developed enough for high-speed lines. Managers who are considering adding a vision system to a production or test line are encouraged to seek out the experiences of other users and to talk to as many manufacturers as possible. If vision options for a robot under consideration are available, the manufacturing manager should ask the following: Is vision an effective option or are mechanical guides more appropriate? Is special illumination required? The latter is a subject often overlooked. Although in many cases, controlled lighting need not be of a special type, it usually must be consistent across the work area. Moreover, the complexity of programming vision systems and the integration of the robotic and vision programming should be examined.

Integration of the robot and the manufacturing processes begins soon after the robot is delivered. Integration consists of the placement of the components, the installation of safety mechanisms, and the determination of system support (programming, calibration, maintenance, and the like).

It is important to look for vendors that offer a system for smooth integration and support. Although a consultant can help with the initial integration tasks, in-house programming personnel usually are required to make future system changes, so it is best to bring them in during the initial integration process.

Physical placement

The physical placement of the robot, its controller, and its tester or assembly table must all be considered in relation to each other (Fig. 2). The robot has been programmed to an accuracy that is sensitive to surrounding conditions. Even a slight flexing of the surface—as tiny as a fraction of an inch—may be intolerable to the robot. The most common form of attachment is to the floor, but the robot may also be mounted on a platform or stand, or on a wall or ceiling. It is important that the surfaces have adequate rigidity to ensure proper support of the robot as it performs its work.

Other installation requirements include the services required by the units and the power requirement and air-pressure or vacuum lines (if needed) for the end effector. The layout must allow easy access to all areas that require periodic maintenance. Cooling air inlets or exhausts must not be blocked.

For safety's sake, the system should include, at a minimum, a prominently mounted panic switch to stop the operation of the robot. The end effector should not open and drop what it is holding when the operation makes an emergency stop. Some robots that depend on power to remain operative will sag or drop if electrical power or hydraulic pressure is lost.

As noted, one critical aspect of robot integration is factory-process integration: the robot must work with the rest of the production line. To determine how the materials to be assembled or tested will be transferred to and from the robot (and from the node to the rest of the

Using existing nodes of automation

The accelerating rate of product evolution in the electronics industry, competititve pressures, and increased emphasis on product quality demand unparalled standards in cost-effective, high-quality manufacturing practices and tools in the 1980s. Products that depend only on innovative features for success will not be enough. To meet increased profitability pressures, new products must be of the highest possible quality and be produced at the lowest possible cost. For these reasons, electronics manufacturers, like their counterparts in many industries, are implementing automated manufacturing.

While the requirement for automated manufacturing is being widely trumpeted, a viable means to implement it at a reasonable cost with reasonably low risk in a real production environment is not as well understood. The most straightforward approach seems to be to provide a total solution in the form of a turnkey automated factory system that controls the entire production process from parts receiving to shipping dock. Though these systems are extremely powerful, they may cost upwards of $1 million.

A less costly approach is to focus on nodes of automation that already exist on manufacturing floors. These can be adapted as the foundations for a distributed intelligence network, and usually take the form of in-circuit testers.

One such factory network system called the 700 Net Workstation—available from Zehntel—uses information generated from in-circuit testers that are already in place. This unit provides manufacturing managers with the data they need to make better decisions concerning staffing, machines, procedures, inventory, and capital investments. Applications programs capture the data that already exists in the production area, store it, analyze it, and forward it to another point in the factory.

Based on a 68010 microprocessor with up to 4 megabytes of main memory, the 700 uses Ethernet and RS-232-C communications standards. The software modules available for this product consist of a paperless repair system, a program generator, a monitor of the test and repair station, and a program management system.

For automated quality control, a work-in-process management system collects and analyzes data from each stage in the manufacturing process. It provides reports to help pinpoint and correct persistent process problems and evaluate component quality standards. A threshold function is often available on these types of programs and will allow the user to set minimum or maximum levels for yield and fault count. If the threshold is exceeded, the program can be set up to report the problem to a specific terminal.

line), the planner should answer some basic questions, among them whether the transfers are to be done manually or by a conveyor belt. If the materials to be used by the robot are fed through a conveyor belt, the conveyor should not supply more material until the robot is ready. Synchronization requires a ready/not-ready signal from the tester and robot to start or stop its conveyor. However, it is important that the entire line does not start and stop with the robot.

Support mechanisms address the coordination of all components of the node, including proper matching of all software components, exact mechanical meshing of the hardware and the establishment of communications—in other words, the glue that holds it all together. For example, it is important that board-handling programs, board-test programs, and fixtures all match so that the robot will not use handling program ZYX to test board UVW.

Close communications

Because it is mechanically aligned with the tester or assembly area, the robot must know not only where the input and output queues are, but also where the machine or tester is. The close communications necessary between the tester or node and robot can result from a direct link between the two, or from a link with a local network. When choosing a direct link, the user can design a local net link from the robot to support communications with the rest of the factory.

Some robots store a number of programs on-line and have additional programs stored off-line that are downloaded into the tester or node as needed. Off-line storage may consist of manually loaded cartridges or floppy disk. Total integration consists of melding the robot into the process so that both data and materials are conveyed accurately and consistently.

If the robot will be unattended, some type of automatic mechanism is required to send out a warning when a problem occurs. Preventive and corrective maintenance procedures and support must address the synchronization of the robot and the rest of the line. The production line should not continue to run when the robot drops something or jams when performing a function. A warning to a human who can help to correct the problem can be a flashing red light on top of the tester or a message transmitted along the factory's data network to a supervisor's console.

Some basic questions

Whether the application is exotic or as simple as lifting parts from one place and moving them to another, a robot's effectiveness can be determined early in the process by developing a strategy directing its selection. But the most important analysis is, of course, the one the accountants must make. Even this task can be made simpler by answering some basic questions: Is the robot expected to contribute to the bottom line through direct reduction of labor costs? Or will it provide increased efficiency in the use of capital equipment? Will it improve quality control and increase throughput? Or is the robot to be used as a learning tool, as part of a long-term commitment to more comprehensive automation? Is automation part of the company's image enhancement? If the answer to even one of these is yes, there is probably a robot is in your future. ☐

Graeme Kinsey is the project manager for factory automation at Zehntel Inc., Walnut Creek, Calif.

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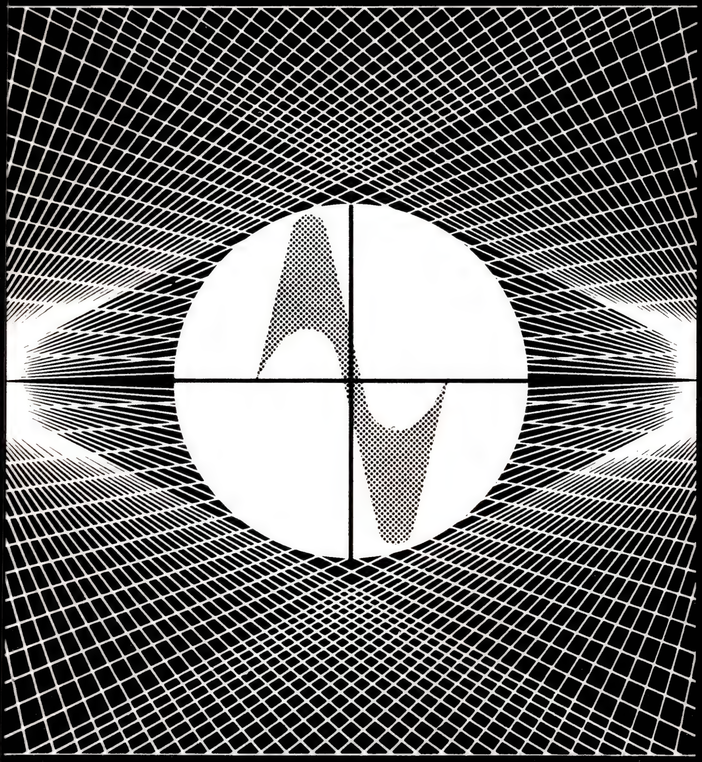

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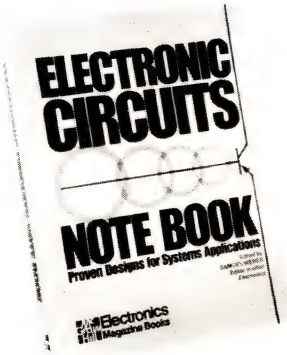
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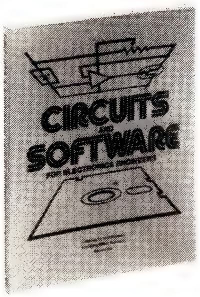

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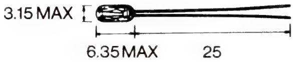

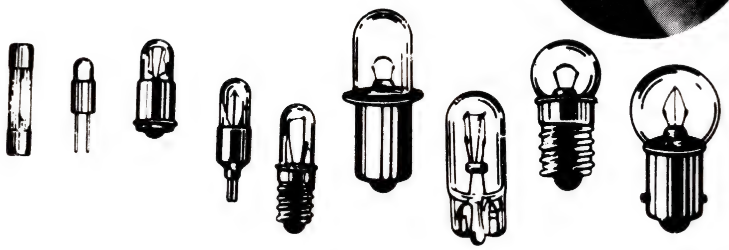

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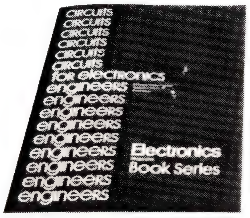

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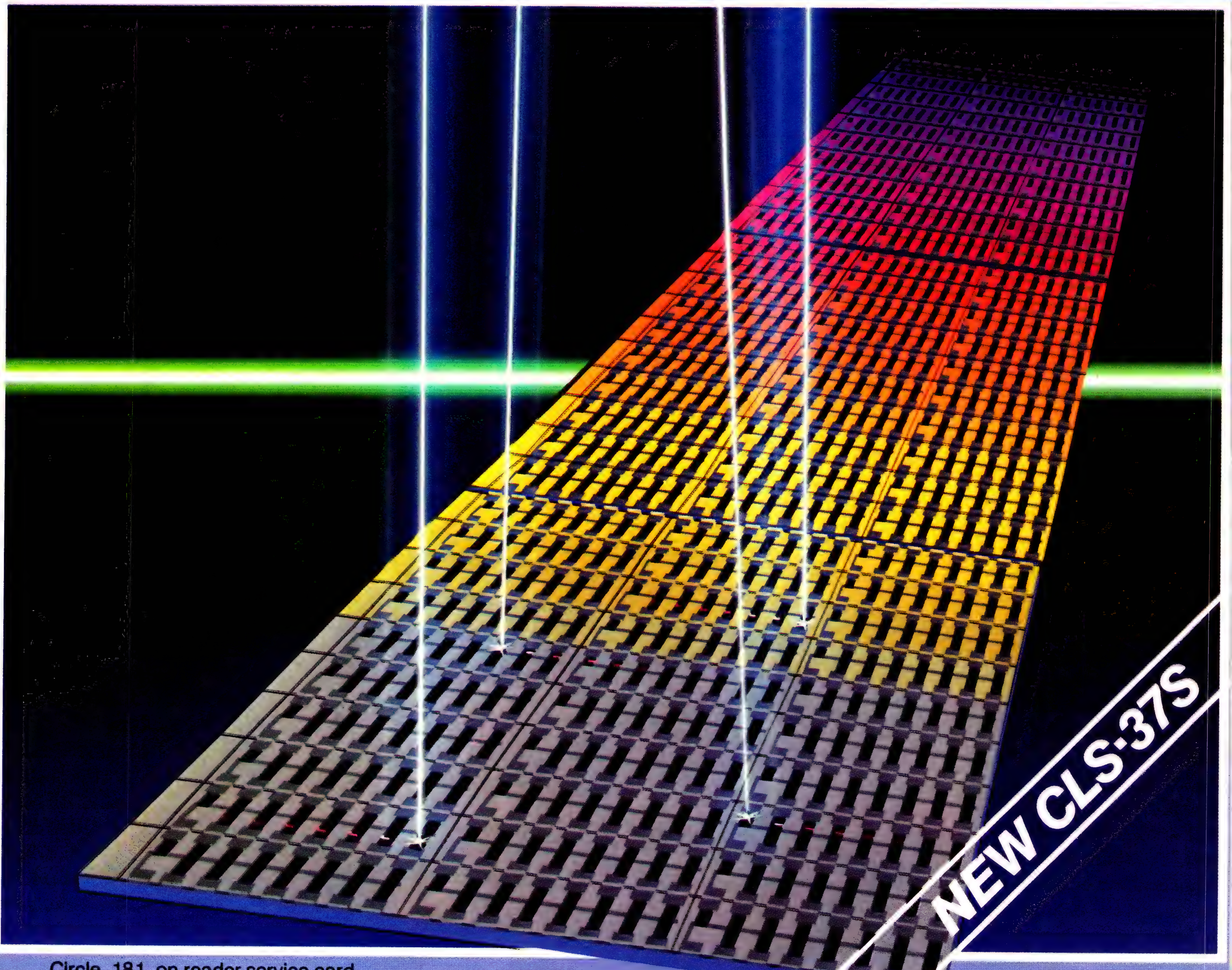

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OLIVETTI INTRODUCES THE 3B UNIX SYSTEM V FOR THE SUPERMINICOMPUTERS OLIVETTI-AT&T 3B

THIS IS WHY FROM NOW ON OBSOLESCENCE IS OBSOLETE

The corporate agreement between Olivetti and AT&T means the development of the most advanced technology and, even more important, technology capable of creating, supporting and guaranteeing standards acceptable worldwide.

EMERGING STANDARD. The UNIX* System V is the emerging standard in operating systems, enabling the transfer of software to different computers quickly, reliably, and with unequalled simplicity. It offers a safer ground for investment by minimizing the problems linked with hardware obsolescence and increasing software costs.

3B SYSTEMS. Created and developed specifically for the UNIX System V, the 3B line is a totally compatible family of 32-bit superminicomputers. In fact, they were designed by the Bell Laboratories to fully exploit the enhanced capabilities of the UNIX System.

CAPACITY & FLEXIBILITY. The following are just a few examples of what is available to both classes of the family's products, the 3B2 and 3B5 systems: C-language, BASIC, Pascal, Fortran, COBOL, dBase II**, Multiplan and Microsoft Word, and the protocols X25, SNA, Ethernet***, etc.

GUARANTEE: UNIX and the 3B systems offer OEM and VAR truly exceptional capabilities in meeting users' needs. But even more, Olivetti and AT&T pledge themselves to continue the upward compatibility of the UNIX System V, thus protecting software investments.

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olivetti

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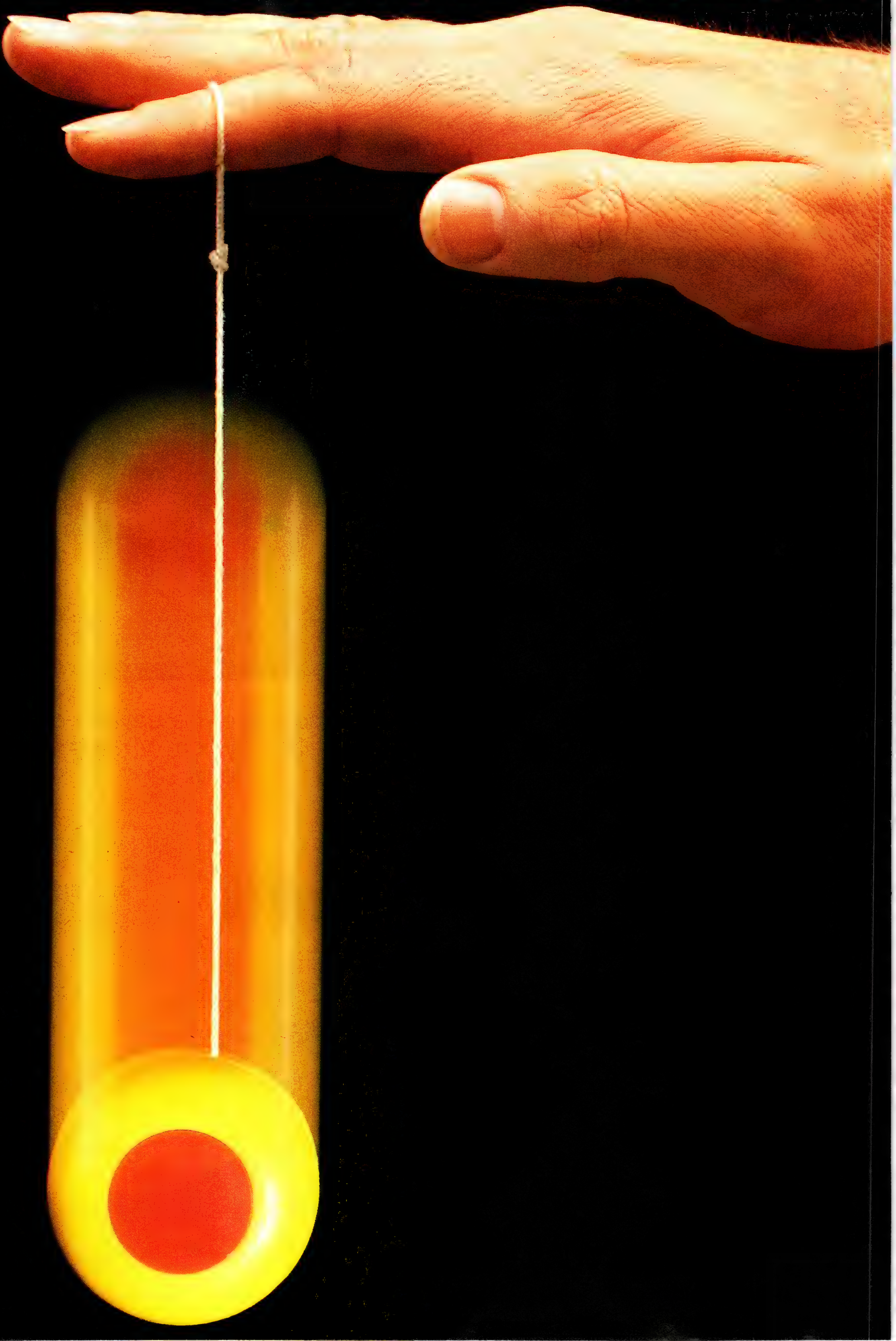
The ups and downs of the Power business



...the growth factors

You know the companies in the power business that appear to be going downhill, and others that cannot compete worldwide. Some seem to lack corporate policy. Others have a poor product range or are weak in major applications.

But constant and aggressive growth is the description that best fits SGS. Our technology is second to none; our increasing number of plants are the most modern, and our product range is growing fast — fastest in the industry.

1 Over 1000 standard types, covering almost every application, and growing by not less than 1 new type every day.

2 Many innovative products including High Voltage up to 1500V, Power MOS types and high power modules up to 35kVA.

3 Seven volume packages – TO-126, SOT-82, TO-220, SOT-93, TO-39, TO-3 and TO-240.

4 5″ wafer capability, ion implantation and other state-of-the-art technologies.

5 Three manufacturing locations in Europe and two in Asia.

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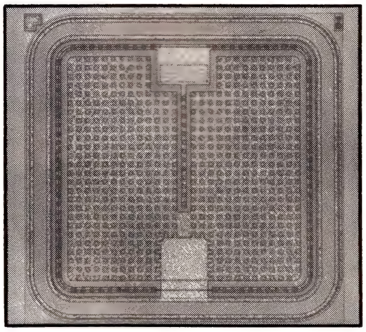
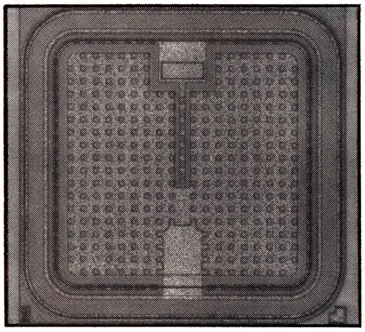
Facts about state-of-the-art Power MOS from SGS

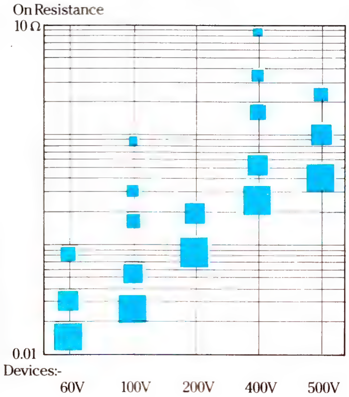
Optimised Power MOS geometries for different voltage ratings combined with proven Power technology make SGS Power MOS transistors the obvious choice to optimise your very high speed switching applications.



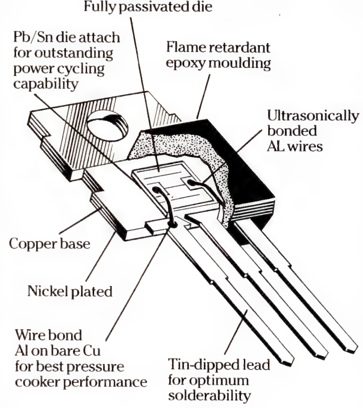
Channel resistance is the limiting factor:
SGS geometry optimised with small cells and minimum spacing.



Drain epitaxial resistance is the limiting factor:
SGS geometry optimised with larger cells and wider spacing.



5 die sizes, 5 voltage ranges and 5 package types give a total product range of over 100 standard devices.


Fully passivated die
Pb/Sn die attach for outstanding power cycling capability
Flame retardant epoxy moulding
Ultrasonically bonded AL wires
Copper base
Nickel plated
Wire bond Al on bare Cu for best pressure cooker performance
Tin-dipped lead for optimum solderability

Power MOS.

Like every SGS Power device, all MOS transistors are available from our worldwide sales organisation. So why not prove these facts for yourself? And gain from our world leadership in power technology.

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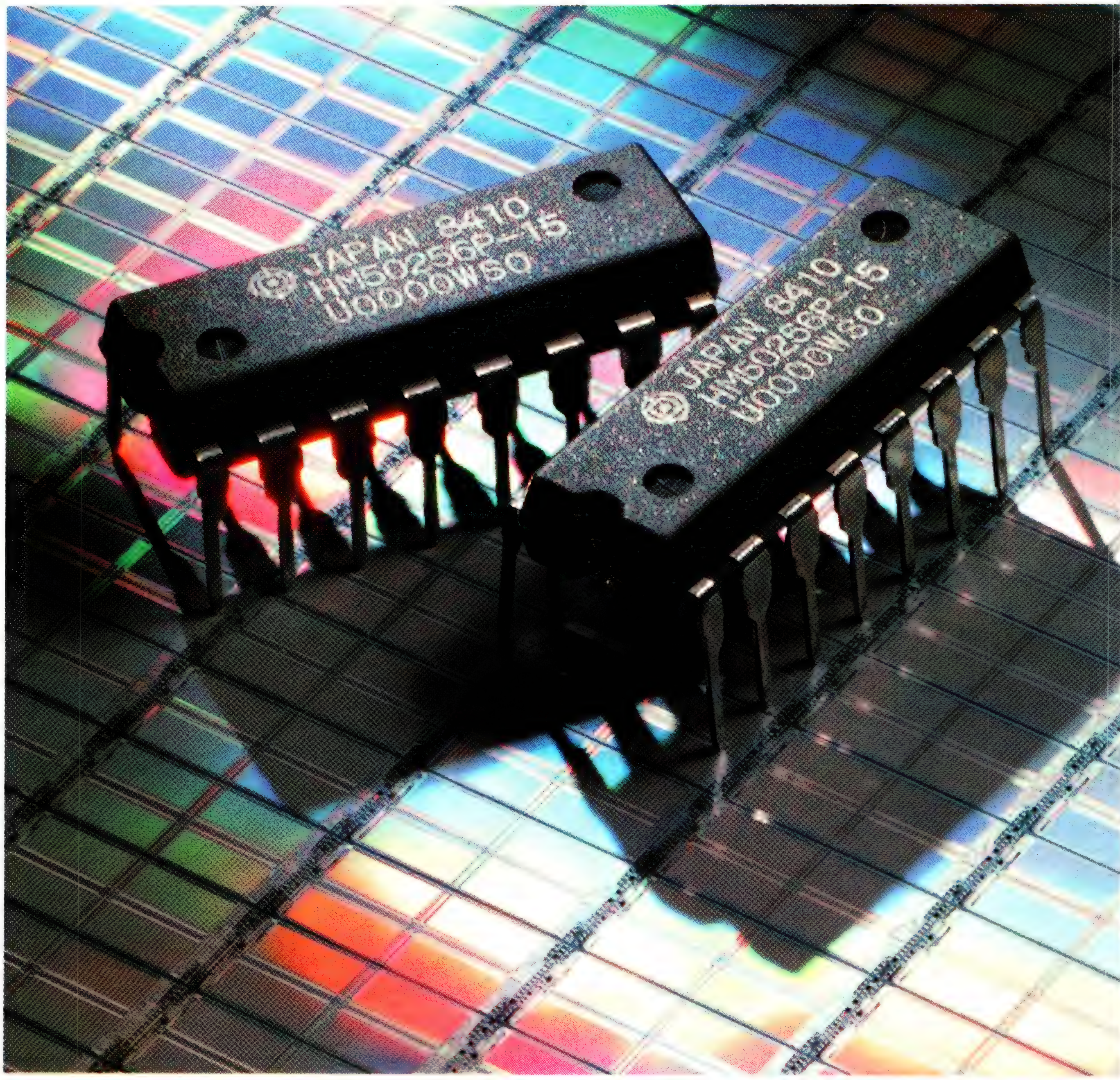
Technology and Service



The newest addition to Hitachi's line-up of dynamic RAMs is the 256-kbit HM50256, taking full advantage of Hitachi's own 2-micron process technology.

THANKS TO HITACHI'S ADVANCED R&D
AND PRODUCTION CAPABILITIES,
THE HIGH-PERFORMANCE DRAMS YOU NEED ARE

READY

At the leading edge of the semiconductor field, a variety of dynamic RAMs are offered by Hitachi, a name renowned throughout the industry for top quality and ready supply. Here are the sought-after products and reliability you demand, based on fine-pattern process technology and circuit design expertise second to none.

With up to 256 kbits

The HM50256 is the very latest in the Hitachi DRAM series, featuring a 262,144 word × 1 bit configuration. It allows conventional high-speed page-mode operation with access times of 120, 150 or 200 ns and provides memory refresh in three modes: $\overline{\text{RAS}}$ only, $\overline{\text{CAS}}$ before $\overline{\text{RAS}}$, and hidden refresh. A nibble-mode type, the HM50257, s also available for 4-bit serial read/write applications. And both types come in a standard 16-pin DIP package for drop-in compatibility with popular 64K DRAMs.

In fact, compatibility is a key consideration n Hitachi's development of new DRAMs. As the trend shifts toward ever larger, faster, more powerful memories, Hitachi DRAM users are assured of continuity of design and performance specifications—a point that's been proven again and again as Hitachi has moved up the scale from its first 1-kbit DRAM to 256-kbit units.

The newest products are the results of Hitachi's own 2-micron process techniques which pack more memory into highly dependable devices. That means exceptional power and compactness in office systems, portable electronic devices, and every application where speed and performance are crucial.

With extensive R&D

Now under development are an 18-pin type with a 64 kword × 4 bit circuit organization and a 28-pin type, 32 kword × 8 bit unit. What's more, Hitachi engineers are working on leadless chip carriers (LCCs) with ceramic packages and plastic leaded chip carriers (PLCCs) to further reduce unit size. Also coming soon: One of the world's first 1M-bit DRAMs.

Such innovations as these are possible because of Hitachi's ongoing commitment to research and development activities, involving the talents of some 16,000 researchers in electronics and other fields. So when you're ready for the best in DRAM technology, deal with a leader. Contact Hitachi.

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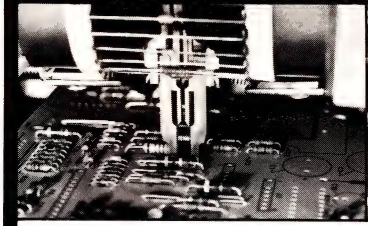
UniversaL Automation in Electronics

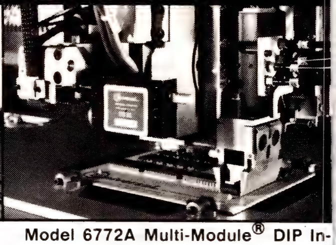
There's a labor-saving Universal Instruments machine or system for almost every electronic assembly manufacturing need. Not just one machine that will do the job for you better and faster, but a whole array of machines, systems and peripheral equipment.

On this page you'll find a cross-section of Universal's extensive machine lines, which ranges from semi-automatic to completely automated production systems. Most systems are modular in design, so you can increase production capability as your volume grows. Among them you'll find the perfect match for your particular need, whether your major interest is increasing productivity, improving quality, or reducing per unit cost.

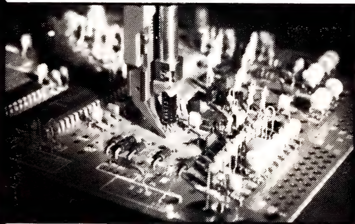
High Speed Component Insertion



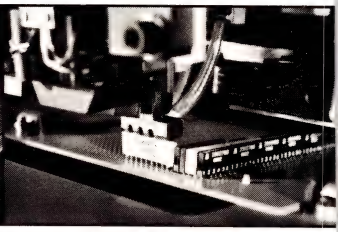
Model 6287A High Speed VCD. The ultimate in automated axial lead component insertion. Cycle rates to 15,000/hr. Rotary table std. Dual head Model 6295A has 30,000/hr cycle rate.



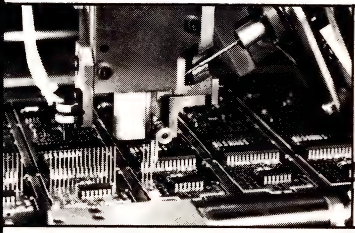
Model 6772A Multi-Module® DIP Inserter. Dual independent insertion heads can be tooled for any two of .300", .400", .600" DIPs w/wo sockets. Up to 70 inputs. Rates to 4,800/hr.



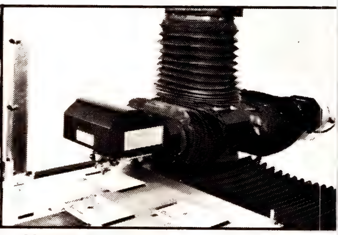
Model 6346A Radial Lead Sequencer/Inserter. Inserts broad range of radial lead devices, including capacitors, peaking coils and "hairpin" axials. Cycle rates to 7,000/hr.



Model 6742A SIP Insertion System can "brickwall" high, medium & low profile molded SIPs with 2, 4, 6, 8 & 10 leads. Up to 46 inputs. Cycle rate to 3,600/hr.



Model 3718A Continuous Wire Inserter forms standard square and round pins from spooled wire as they are inserted at high speed. No more pins to inventory. Tooling for fluted pins available.



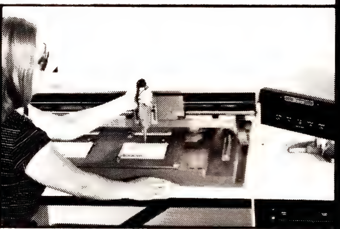
Model 6511A Electronic Assembly Robot inserts non-standard devices that cannot normally be automatically inserted due to size, body shape, or lack of standardized shape.

Semi-Automatic Assembly Machines

Model 6232A Man-U-Sert® Manual Assembly Machine automatically positions PC board, shows operator exact insertion location, and cuts & clinches leads after insertion.

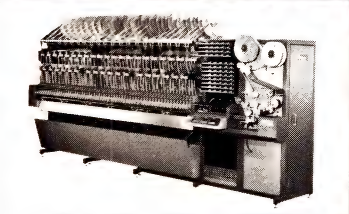
Model 6235A Logpoint®. CRT guides operator in conversational manner. Overhead light projects symbol on board at insertion location. Sequential or random access parts bins.

Model 4511A Logplace™ is a manually assisted surface mounted component assembly system. CRT guides operator. Overhead light precisely locates chip placement with symbol.

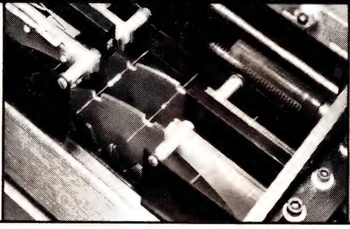


Model 6893A Program Generator. Speeds preparation of insertion pattern programs. Measures coordinates from PC board. Up to 2,000 points an hour. Can inspect incoming boards.

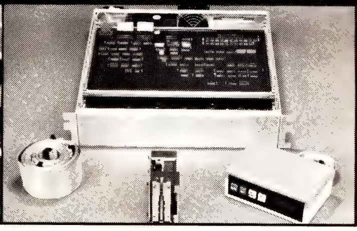
High Speed Component Packaging & Verifying



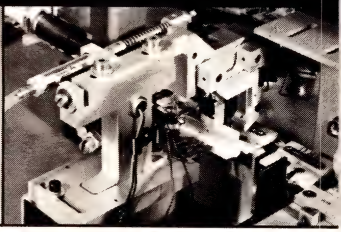
Model 2596A Expandable Component Sequencer for axial lead parts including jumper wires. Rates up to 25,000/hr. Modules can expand from 20 to 160 input stations.



Model 2862B On-Line Sequence Verifier. Mounts on Model 2596A. Detects missing, out-of-sequence, faulty, or misoriented parts, and stops machine for manual parts replacement.

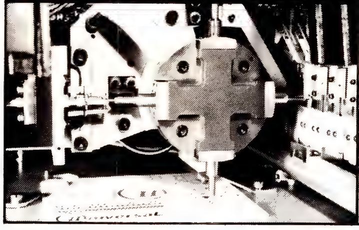


Model 2866A On-Line DIP Verifier. Verifies correct type, function and proper orientation. Ejects bad parts. Can replace rejected part automatically.

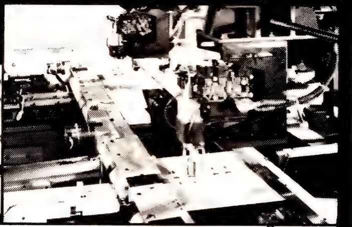


Model 2865B On-Line Radial Lead Component Verifier. Checks for missing, out-of-tolerance and faulty parts. Halts machine for manual substitution of bad parts prior to insertion cycle.

Surface Mounted Component Assembly

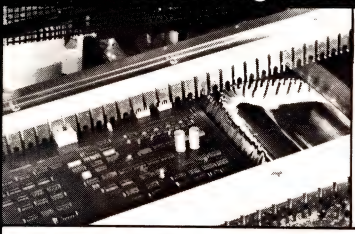


Model 4712A Onserter™ sequences, verifies, orients and places surface mounted components on PC boards. Handles variety of components. Operates at rates to 6,000 cycles/hr.

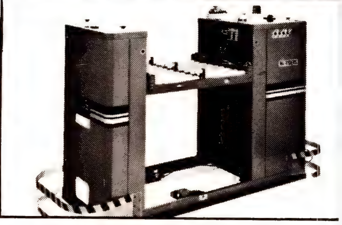


Model 4621A X-Y RHyMAS® dual placement heads and positioning systems. Rates approaching 4,500 components/hr. Handles PC boards or substrates. Inputs include tape, matrix trays, stick feed and bulk.

Soldering & PC Board Handling



Model 6422A Finger Conveyor Solder Machine is designed to solder large PC boards fast & reliably, with minimal servicing required. Other models from "Mini" to Computer Controlled.



AGV—Automated Guided Vehicle services islands of automated ass'y, intermediate buffer-transfers, conveyorized assembly lines, parts from warehouse, complete assemblies.

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MUX CARD GIVES LSI-11s 16 LINES

Dual-size Q-bus multiplexer card gives LSI-11 computer systems 8 or 16 independently programmable communications lines ☐ *by Steve Zollo*

With 16 lines, the model 309 Q-bus communications board has double the capacity of current communications multiplexer cards for Digital Equipment Corp. LSI-11 microcomputers. The asynchronous multiplexer, which is built on a dual-height board, is compatible with DEC's DH-11 software.

According to Albert Grant, president of Grant Technology Systems Corp., "The model 309 provides a cost-effective method of connecting multiple local or remote terminals and peripherals at data rates of up to 38.4 kilobaud using an RS-232-C or CCITT V.24 interface." In single quantities, the 16-channel card sells for $1,595; an eight-channel version sells for $995.

Among the card's features are extended 22-bit addressing, a four-level interrupt, a 192-character first-in, first-out receiver buffer that reduces the burden on the central processing unit, an on-board direct-memory-access controller that transmits data from software-defined buffer areas, programmable baud rates, and software-transparent data-flow support.

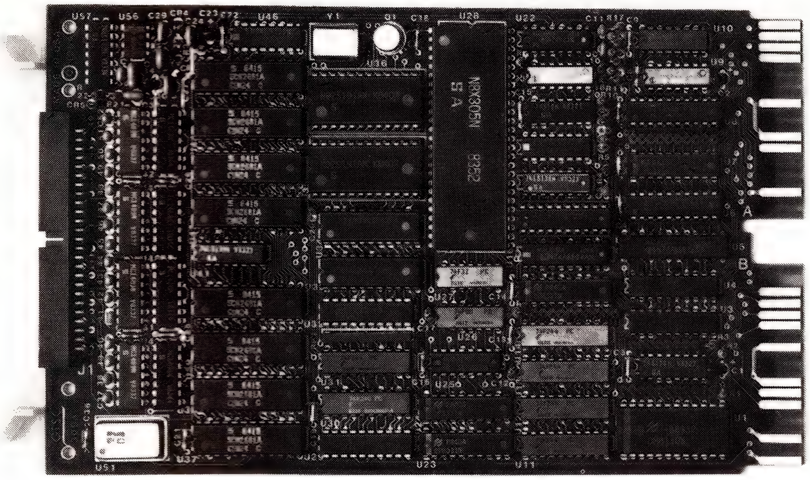
Competing multiplexer cards have only 8 lines on a dual-size board or take a quad-size card to provide the same 16 lines as Grant's board, explains Thomas McLeod, vice president of sales. The trick to packing so many lines on the card was to use a microcontroller-based architecture rather than the bit-slice technique used by DEC and the other competitors. Grant uses the Signetics 8X305 microcontroller, which "is designed to be a bit banger in the communications world," McLeod says. "It's an ideal controller."

With the bit-slice technique, engineers essentially design their own computer. "We don't want to be a designer of a computer. We want to offer a good price-performance ratio. Our marketplace requires that we are cost effective," remarks McLeod.

Split send and receive rates are programmable for each channel. Data can be sent in half- or full-duplex modes in a serial asynchronous format, with the least significant bit first (5, 6, 7, or 8 bits/character with one start bit). Other format variations include 5-bit codes with 1 or 1½ stop bits/character and 6-, 7-, or 8-bit codes with 1 or 2 stop bits/character. In any format, there can be no parity, or it can be even or odd. The format for transmitted and received data is independently selectable through software for each line.

Each of the card's transmitters operate from a 64-K-byte memory buffer under DMA control. Receivers each have a four-character buffer. A 128-character FIFO buffer provides further receiver buffering. All transmit buffer areas can be relocated over the entire 22-bit address space.

Breaks may be generated and detected on each line under program control. The card is completely compatible with DEC's four-level interrupt structure. Interrupt conditions—buffer overflow or transmitter buffer empty and nonexistent memory—may be enabled or disabled under software control. Interrupt levels 4, 5, 6, and 7 are



fully supported. The 5.2-by-8.9-in. board requires +5 V at 3.0 A and +12 V (±10%) at 0.5 A. The model 309 will be delivered starting this month.

The company also promises to make available as an option input/output panels that can directly connect up to 24 terminals with a single 5-in.-high, 19-in. rack-mountable panel.

Grant Technology Systems Corp., 11 Summer St., Chelmsford, Mass. 01824.
Phone (617) 256-8881 [Circle reader service number 338]

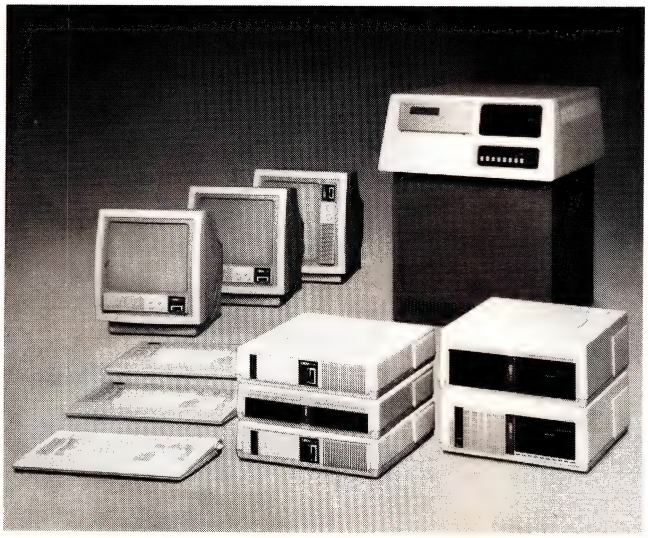
16-bit business computer runs many popular programs

A 16-bit personal computer that is compatible with industry standards will run most software, including Lotus 1, 2, 3, Flight Simulator, dBASE, WordStar, and Frogger. The NCR model 4 has an 8088 processor and 128-K bytes of memory, expandable to 640-K bytes. Features include compatibility with the IBM Personal Computer and PC XT, an on-line help program, user diagnostics, and a random-access memory functioning like a disk to allow faster than normal access to files. Five expansion slots are included, as is a printer interface. Its language, GW-Basic, has advanced graphics capabilities. The NCR model 4 costs $2,825, without peripherals.

NCR Corp., Dayton, Ohio 45479.
Phone (513) 445-2075 [Circle 361]

Systems integrators get modular IBM PC-like products

Many companies manufacture machines that are compatible with IBM Personal Computers for retail sale; Oemtek Inc., a year-old company in San Jose, is going after the original-equipment manufacturer, the systems integrator, and the value-added retailer. Oemtek offers a flexible, unbundled product line and claims a commitment to service, with the assurance that the purchaser will get a system that exactly fits his needs. According to James L. Siehl, the firm's president, "The prepackaged systems now offered are typical of retail, where sales expertise is minimal, applications skills almost nil, and the machine more generalized. [But] the OEM needs a modular product line from which he buys only what he needs at low competitive prices."



The heart of the architecture Oemtek uses for its machines is Intel's 8088, 8086, and 80286 microprocessors; the industry-standard IBM PC and PC XT; and the Intel Multibus bus structures. The 8088 serves as the all-purpose work station, while the 8086 and the forthcoming 80286 are the processors of choice for the Multibus-based network file server. The central-processing-unit boards have an extra 28-pin socket for adding a read-only memory intended for copy-writable software that the system integrator may add.

Five basic modules are available: keyboard, a low-profile computer and data-storage module, a standard-profile system and data-storage module, monitors, and the 8086-based (or eventually the 80286-based) file server. These modules can be configured for stand-alone personal-computer use with no communications requirement, shared-resource use (often involving 3270 emulation and minicomputer processing capability with local storage), or networking.

Operating systems available include MS-DOS, Concurrent CP/M, and Magix, which is an applications generator and networking tool. Magix, says Science Dynamics, will reduce program maintenance by as much as 90%, since it eliminates almost altogether code debugging and documentation quality-assurance checks. The company says systems will sell for half the price of comparably equipped IBM PCs.

All systems are available now, according to the company.

Oemtek Inc., 3707 Williams Rd., San Jose, Calif. 95117. Phone (408) 247-1100 [Circle 381]

Military EEPROM needs only 5-V supply for all modes

An electrically erasable programmable read-only memory, the model NCR 52864-HR, has a maximum access time of 350 or 450 ns over the military temperature range of –55°C to +125°C. The highly reliable, high-density EEPROM requires only a single 5-V power supply for all modes of operation.

The high voltage necessary for erasing and writing the memory cell comes from an on-chip generator. Operational power consumption is 330 mW maximum; in the standby mode, the EEPROM consumes a maximum of 165 mW. Erasing data from the model NCR 52864-HR is done either in a chip or a page fashion. Data can be written or stored either a single bit at a time, or as a page of up to 16 bytes. The EEPROM includes a feature that allows device data retention time to be objectively measured and projected.

The EEPROM is fabricated with the company's n-channel silicon-nitride-oxide-silicon process. The number of possible store-erase cycles is guaranteed to be at least 10,000 with a 10-year retention. Suited for a variety of

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rcle 186 on reader service card

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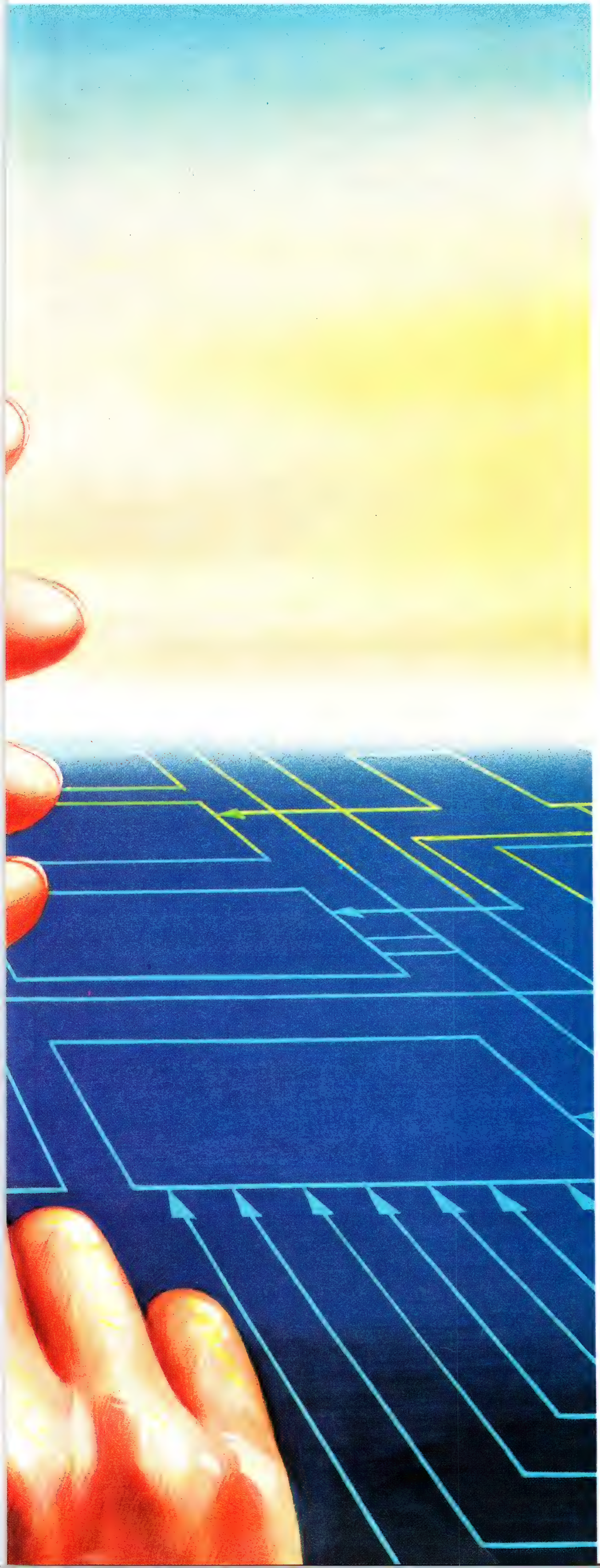

Looking for the logical way to put your logic into silicon? Just push some buttons and call MIETEC.

With an experienced **design** team and a brand new **production** plant, at one hour from Brussels, MIETEC is ready to deliver you **the chip you want for the price you were dreaming of**.

MIETEC is the only European semi-conductor house that offers you custom and semi-custom chips in a **complete range of state-of-the-art technologies**: **3 μm NMOS**, **3 μm CMOS**, **BIMOS** and **HVMOS,** a unique and trailblazing **MIETEC technology** which allows the control of high voltage switches (up to 400V) with a low voltage CMOS logic on the same chip.

MIETEC offers you a choice of design solutions:

- Our design team has an outstanding record including many big telecom chips and a large number of automotive, appliance and military products. They're best placed to integrate your application in a full custom approach, using the most advanced CAD tools.
- You want to bring your new application into production quickly? Our comprehensive library of standard cells is at your disposal.
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MIETEC wants to collaborate with you at any level:

Either we take care of everything. Just give us a specification and a few months later we deliver you prototypes. **Or you do the job yourself**. We give you our design rules or our cell library.
In case you want to start with semi-custom, we'll **teach you on your application**. Our designers will co-operate with you and they'll do it properly, because **MIETEC takes the responsibility of the design**.

Whatever option you make, our location in the heart of Europe (near Ghent, less than an hour from the Brussels international airport and near to Europe's major highway E3) is your guarantee for complete control of all stages of the process.

That's why MIETEC is the only logical way to get the chip you want: just push the buttons, call 32/55/33.22.11 and consider the job done.

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Circle 187 on reader service card

military, telecommunications, and speech recognition applications, the device, when ordered in quantities of 100, sells for $298.88 each in 28-pin ceramic dual in-line packages and $323.88 in 32-pad ceramic leadless chip carriers. Both parts have an industry-standard byte-wide pinout. Samples are available now.

NCR Microelectronics Division, Product Marketing, 8181 Byers Rd., Miamisburg, Ohio 45342. Phone (800) 543-5618 [Circle 342]

Analyzers monitor protocols at speeds up to 256 kb/s

An addition to a line of protocol analyzers, model HP 4953A features remote-control capability and full compatibility with models HP 4955A and 4951A. With the analyzer, users can monitor transmission or simulate network components.

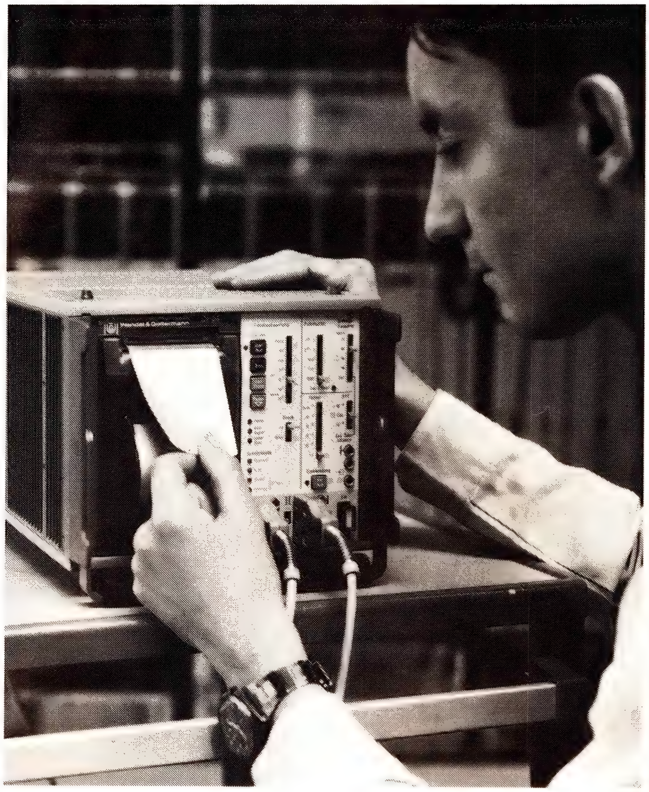
The model HP 4953A can monitor bit-oriented protocols at speeds of up to 256 kb/s as well as provide complete simulation at speeds of up to 72 kb/s without losing the triggering capability. Thanks to its remote-control capability, users can download a test to another model HP 4953A, execute the measurements, and upload the results from the other unit, even if unattended. Separate ports on the analyzer allow concurrent remote testing and monitoring without switching data links.

The model HP 4953A displays a number standard protocols such as X.25, X.75, and bisynchronous, in addition to user-definable character-asynchronous and -synchronous protocols. Though its data codes are ASCII, EBCDIC, Baudot, EBCD, and Transcode, the user may define others and store them on tape for future use. Users are led by setup and test menus. The model HP 4953A sells for $12,000; delivery takes six weeks.

Inquiries Manager, Hewlett-Packard Co., 1820 Embarcadero Rd., Palo Alto, Calif. 94303 [Circle 343]

Error-rate measuring set suits PCM multiplexers

An error rate measuring set, the DF-64, determines bit- and block-error ratios on analog and digital data-communications channels operating at 48-, 56-, 64-, and 72-kb/s and then records them on a built-in printer. It is suitable for making measurements on pulse-code-modulated multiplexers with interfaces conforming to the International Telegraph and Telephone Consultative Committee's recommendation G.703 and on modems with interfaces complying with CCITT V.11. The measuring range for bit-error ratio is 0×10^{-7} to 3.33×10^{-1}.



When used as an external error counter, which has a range of 0 to 99,999, the compact model DF-64 records the bit errors of applied external signals up to 2 Mb/s. A pattern generator in the unit's send section generates a variety of pseudorandom sequences and bit patterns with a high frequency accuracy. With switchable detuning of the bit rate, data communications systems can be tested at extreme clock frequencies.

Priced at about $4,300, the model DF-64 is now available.

Wandel & Goltermann Instruments, 119 Naylor Ave., Livingston, N.J. 07039. [Circle 344]

Programmable electrometer boasts sensitivity of 0.1 fA

A 4½-digit programmable electrometer features a sensitivity of O.1 fA least significant digit for current measurements, voltage measurements from 100 μV to 200 V, resistance measurements to 10^{16} Ω, and charge measurements from 10 fC to 20 nC. All these functions can be computer-controlled over the IEEE-488 bus.

The model 617 Electrometer/Source's capabilities are expanded with integral sources, which permit two methods of measuring high resistance or making current voltage curves. Its programmable isolated ±100-V source, with 50-mV resolution, can be used with the current

For the manager who is serious about improving product quality and lowering production costs...

HP introduces the Q-STAR network

Move into the age of computer integrated manufacturing with HP board test systems and HP's exclusive Q-STAR network.

Q-STAR (Quality Systems for Test, Analysis and Repair) is an integrated approach to solving your manufacturing test problems when your requirements call for more than just a test system. Analysis of the test data provides information you can use to solve your manufacturing process problems.

With the HP 3065 Board Test System, you can test your complex analog/digital PC boards. HP's Q-STAR network gives you detailed process data to help fine tune your entire manufacturing and assembly process. You can use this information to smooth out your production process as well as greatly increase your product quality. Use Q-STAR to identify chronically bad parts and subassemblies. Search out the weaknesses in the build procedure. Minimize product rework. Control production costs and boost product quality by maintaining tighter, more informed control of the production cycle.

In addition, HP paperless repair software provides automation of your repair process, speeds the repair and provides insight into what actually happened, permitting rapid identification of subtle manufacturing process problems.

Improving Product Quality.

With HP's Q-STATS and paperless repair software (part of the overall Q-STAR system), you can get management, utilization and process yield reports to help you reduce inventory and improve your process. To provide a total solution to your testing problems, HP offers this capability as a standard no-charge feature of the HP 3065 Board Test System. Plus, by taking advantage of Q-STAR's compatibility with HP's much larger Manufacturer's Productivity Network (MPN), you have a powerful set of tools for increasing product quality.

Lowering Production Costs.

The HP 3065 Board Test System provides the highest throughput possible today. That means your test backlogs become significantly reduced. Get your new products into production faster with the new HP CAD-VANTAGE software. A vital component of the HP Q-STAR network, this software automatically links any CAD database to an HP 3065, freeing you from laborious manual entry of board topology. Once your CAD data is transferred, HP's advanced IPG-II test program generation package lets your engineers produce efficient test code. For greater responsiveness to increasing production schedules, each HP 3065 controller can support up to six configurations including three test heads, six development and repair stations, or a combination of your choice.

With the HP Q-STAR network, you can improve product quality while lowering production costs.

Hewlett-Packard provides a complete line of board test systems, featuring a wide selection of capabilities and prices to satisfy most production test applications. To find out more, contact your local HP field office listed in the telephone directory white pages. Ask for the electronic instruments department.

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measuring function to determine resistances up to 10,000 TΩ. With the voltage source, resistances can be measured at a fixed voltage, or I-V curves can be generated using a forcing voltage.

Using an internal decade current source with steps from 1 nA to 100 μA, and reading voltage, resistance measurements to 100 GΩ or I-V characteristics using decade current steps can be obtained. The instrument's dc current accuracy, for one year, is 0.15% on the microamp ranges, 0.25% on the nanoamp ranges, and 1.6% on the picoamp ranges. Autoranging is provided over the full span of ranges on voltage, current, charge, and resistance functions.

Available now, the model 617 sells for under $3,000.

Keithley Instruments Inc., 28775 Aurora Rd., Cleveland, Ohio 44139. Phone (216) 248-0400 [Circle 345]

Chip controls hard disks, floppy disks, and tape drives

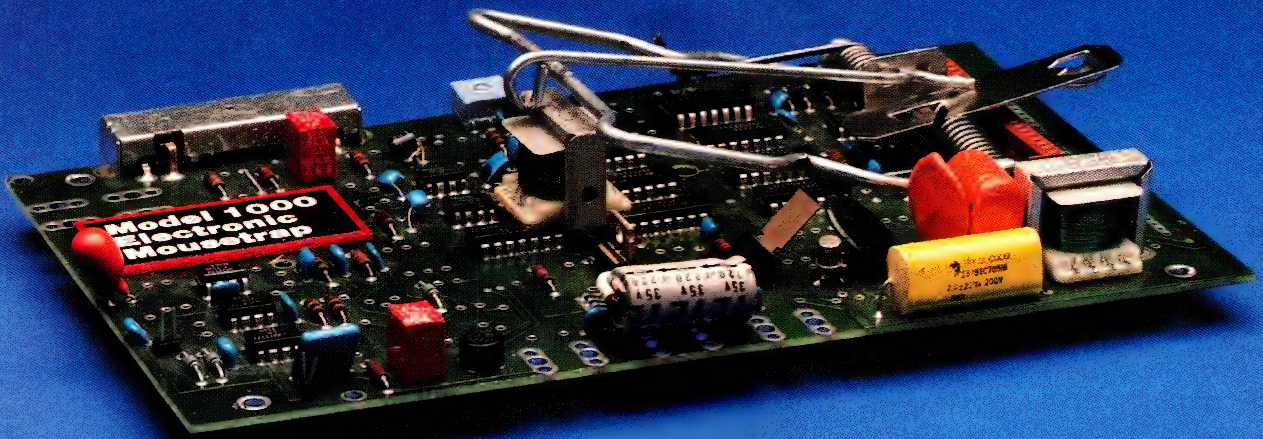
A single-chip disk controller, the model HDC 9224, combines the functions of hard disk, floppy disk, and tape drive controllers. In addition, the model HDC 9224 offers such features as built-in error detection and correction, a programmable automatic retry option, built-in precompensation logic, and a user-programmable 24-bit direct-memory-access controller.

The HDC 9224 can be linked to many ST506-compatible hard disk drives. Its flexible-format command lets users select hard disk sector sizes of up to 16-K bytes in length, and the system can work with interleaved as well as noninterleaved sector formats. It controls many types of floppy drives, including 8-, 5¼-, and sub-5-in. models, and can read and write many single- and double-density floppy disk formats, and controls up to four drives simultaneously.

Compatible with many processors, including the 8088, 8086, and 68000, the HDC 9224 features a flexible bus interface and interrupt structure. Its high-level command structure makes it simple to interface the system to many operating systems, including

"If you make a better mousetrap, the world will make a beaten path to your door."

Ralph Waldo Emerson, 1855



"If you design a better mousetrap, the world won't necessarily make a beaten path to your door."

ElectronicsWeek, 1984

In the electronic Eighties industry needs better decisions, not just better designs.

Electronics, the world's most dynamic industry, is changing. And Electronics, the magazine that covers the industry, has been changing right along with it.

Ralph Waldo Emerson was wrong.

Better designs are no longer the only keys to success. In the electronic Eighties a company must make better decisions. And they can only be made consistently by industry professionals who are well informed.

Today, good technical and business decisions must be based on a broad understanding of where the industry is. And where it's going.

In other words, with the kind of insight that only a classic industry publication like Electronics provides.

More disasters to come?

The bankruptcy of Osborne, and RCA's $580-million videodisc write-off are just the tip of the iceberg. More possible disasters lie hidden in the future.

And they can only be prevented by decision makers who, regardless of discipline, possess the most complete, accurate and current industry information available.

This is the
last issue of
Electronics.

JULY 12, 1984

MICROCOMPUTER WORLD NERVOUSLY AWAITS IBM'S PC II/83

Fast 32-bit Futurebus anticipates new architectures/108

Active matrix addressing improves flat-panel displays/113

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Which is why Electronics is now ElectronicsWeek.

The electronics industry is growing up. And Electronics, the voice of the industry, is growing along with it.

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McGraw-Hill is just adding the word "Week" to our 54-year-old "Electronics" name. From now on readers of the magazine that gave the industry its name will be able to get more of the same information, more often.

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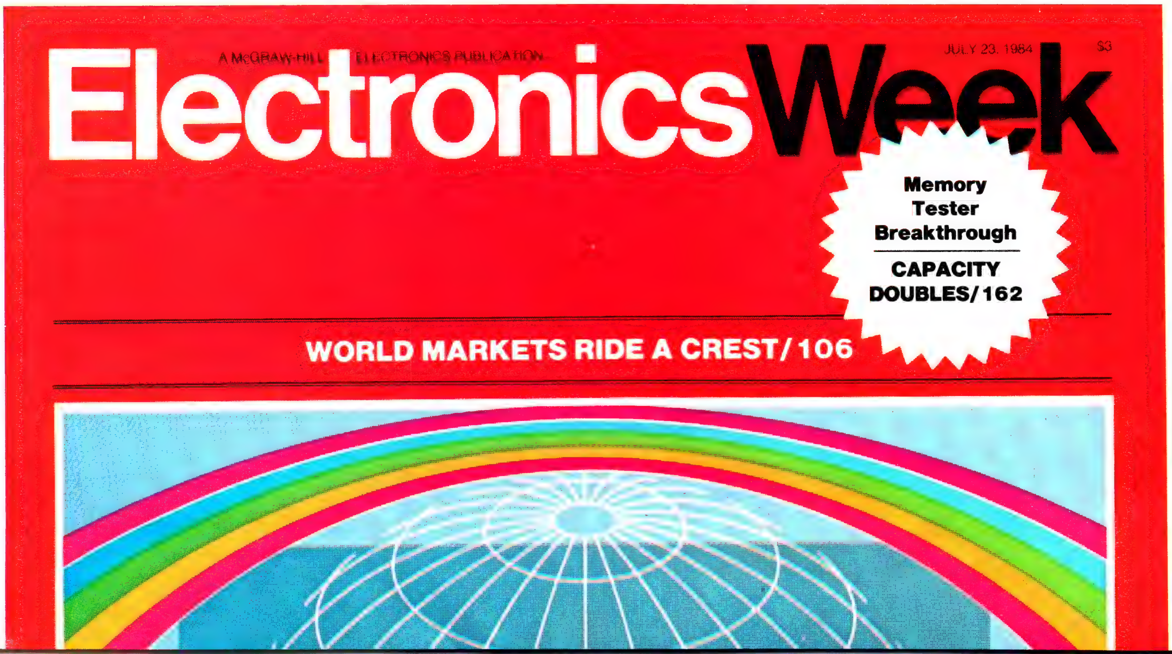
Our exclusive worldwide circulation attests to an excellent international editorial product. One that is more respected and relied upon than any other publication in the electronics industry.

Starting July 23, ElectronicsWeek, the voice of the industry, will be heard each week.

This is the first issue of ElectronicsWeek.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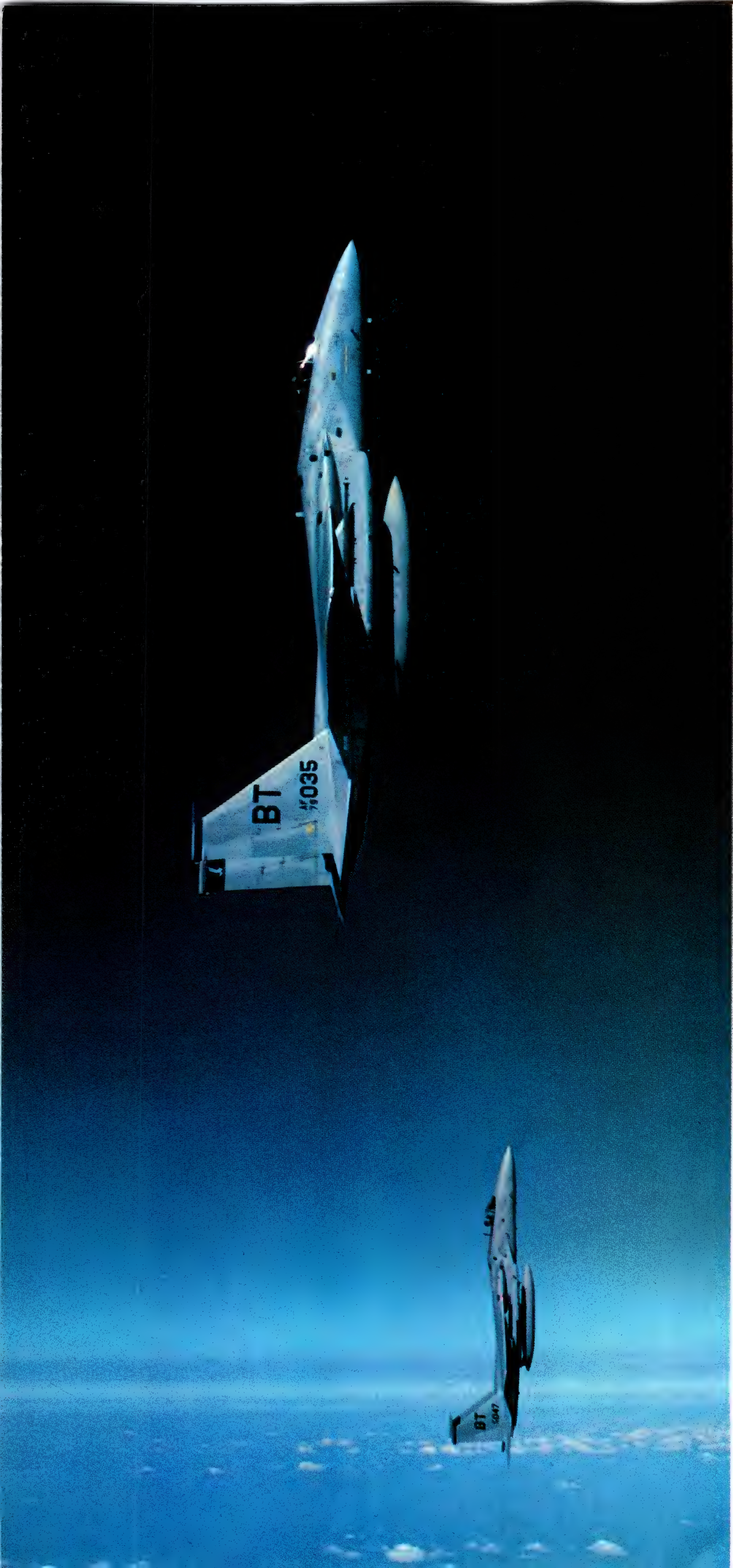
ElectronicsWeek
Memory Tester Breakthrough
CAPACITY DOUBLES/162
WORLD MARKETS RIDE A CREST/106

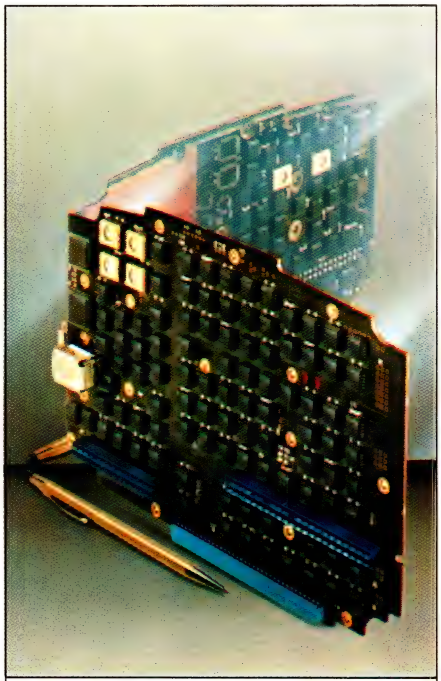


Texas
make

As Collins Avionics and Singer-Kearfott developed JTIDS*, the new communications system for the F-15 fighter, Texas Instruments helped solve a severe circuitry packaging problem.

The new system utilizes the most advanced chip packaging technology, the leadless chip carrier. Design objectives called for 191 components to be surface mounted on both sides of a 6″ × 8.5″ printed circuit (PC) board—and to dissipate up to 40 watts of power.

But, during thermal cycling tests, the difference in the thermal coefficient of expansion (TCE) between the ceramic chip carriers and the conventional PC



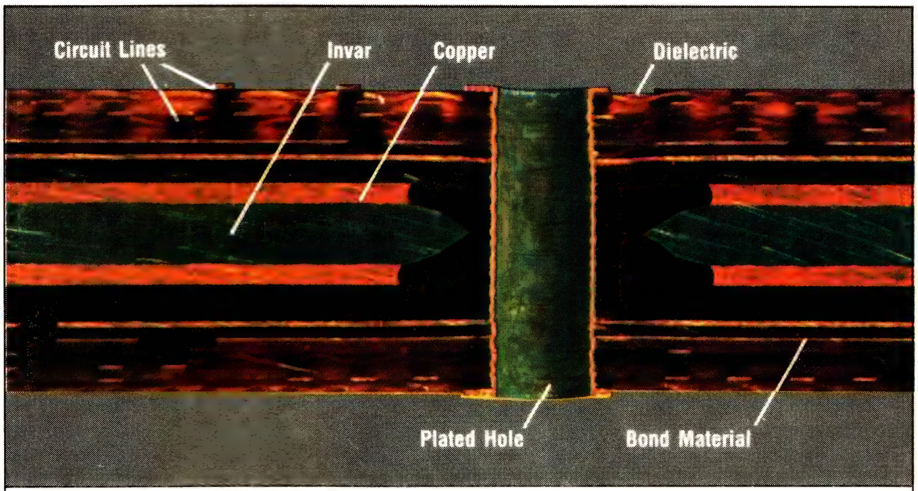
Successful application of high-density packaging was achieved in the PC boards of the F-15's new communications equipment. TI's clad metal system solved thermal expansion mismatch. This mirror-reflection photo shows how ICs were mounted on both sides of the PC boards.

---

*Joint Tactical Information Distribution System

◀ **Improved reliability** in the F-15's new communications system (JTIDS) is achieved with TI's copper-clad Invar used to prevent solder joint breakage on densely populated PC boards. TI teamed up with Collins Avionics and Singer-Kearfott to meet the demanding packaging requirements of the fighter's receiver/transmitter.

Instruments and Collins Avionics dense circuit reliability soar.



Effective thermal management is achieved with a copper-clad Invar core that acts as a support for circuitry in the PC board. Heat dissipation characteristics of the copper are excellent, and the Invar contributes rigidity and strength.

board caused the solder joints attaching the components to the board to break.

TI's solution: A composite metal core of low-TCE Invar that is clad on both sides with copper. Thin, polyimide-glass, multilayer boards were bonded to each side of the metal, to provide the circuitry function.

With a TCE match between the board and the chip carriers, the PC boards easily passed the exacting thermal cycling tests.

And the metal core in the board dramatically improved thermal conductivity and overall rigidity.

Solves thermal mismatch problems

As Collins Avionics discovered, the advantage of using chip carriers to achieve high-density, high-performance circuitry also imposes stringent demands for increased thermal management, structural integrity, as well as TCE compatibility—demands met by Texas Instruments copper-clad Invar.

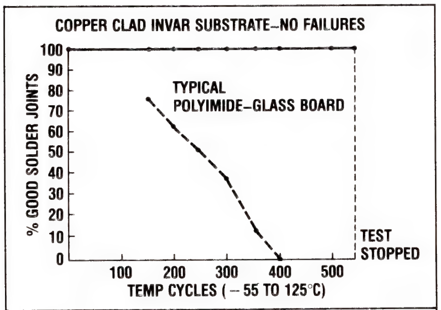
By combining TCE compatibility with high lateral thermal conductivity. And mechanical rigidity.

All at lower cost than alternate approaches.■

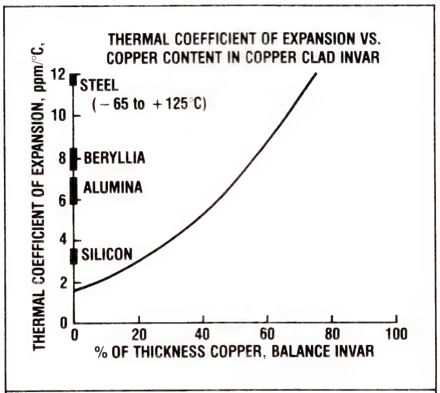
The solution is a trilayer metal.

TI's process involves roll bonding copper foil to Invar—a 36% nickel/64% iron alloy. The bonding to each side of the Invar is accomplished by the same process used to make thermostat metal and coins. No adhesives or brazing alloys are required to achieve a permanent bond.

By varying the ratios of the high thermal conductivity copper to the ultra-low TCE Invar, the TCE of the clad metal can be tailored to match that of silicon, alumina, or beryllia.



After 540 thermal cycles from −55° to 125°C failed to break chip carrier solder joints, Collins Avionics halted tests of PC board used in F-15 communications system. Reliability goals had been surpassed by a wide margin.



Matching the TCE of the metal core of a PC board to chip carrier ceramic is accomplished by bonding the correct ratio of copper to Invar.

This material is available in thicknesses from 5 to 62 mils (.13 to 1.57 mm). You can get it in widths up to 24 inches (610 mm).

Copper-clad Invar is being developed for many other applications: From ground and power planes in multilayer boards, to heat sinks and covers for multichip ceramic modules, and more.

A clad remedy to packaging challenges

TI's innovative clad metal solutions can solve your circuitry packaging problems—with a variety of materials.

You can get copper-cored electron tube materials; nickel-clad stainless steel transistor can materials; copper-clad stainless steel lead frame materials; precious metal, aluminum, and solder selective cladding on base metals for lead frame and connector applications; copper-clad steel, aluminum, and Alloy 42 wire products; and high-speed precision stamping and assembly.

In fact, TI—the world's leading clad metals manufacturer—can help you develop a clad metal solution to many electronic materials problems.

For information, contact
Texas Instruments Incorporated,
Dept. MMJ903EC, P.O. Box 401560,
Dallas, TX 75240. 1-800-341-5202.

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And now for the first time Boeing will build your next power supply. With radiation hardening, high density packaging, built-in test and modular designs.

Whatever your power supply problem, Boeing comes through with innovation, performance and reliability.

For more information, contact Al Mateu, Boeing Electronic Systems, P.O. Box 24666, MS-87-11, Seattle, WA 98124. Telephone (206) 773-0818. BOEING

Circle 148 on reader service card

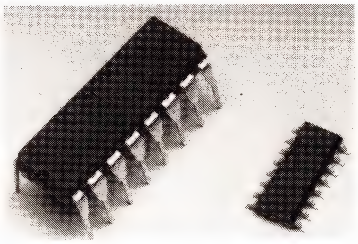
MS-DOS and CP/M. Fabricated with the company's n-channel silicon gate technology, the model HDC 9224 is available in 40-pin ceramic and ceramic dual in-line packages. The price for cerdip versions is $65.50 each in 100-lot orders.

Standard Microsystems Corp., 35 Marcus Blvd., Hauppauge, N.Y. 11788.
Phone (516) 273-3100 [Circle 346]

Communications ICs perform in low-power rf applications

Two radio-frequency integrated circuits featuring high sensitivity and low power consumption are suited for a variety of low-power and portable communications applications, including cellular radio. The model SA602 double-balanced mixer/oscillator, which operates at up to 500 MHz, features an on-board oscillator with a frequency-generation capability of up to 200 MHz.

The oscillator is an emitter-follower type that can buffer input from an external oscillator; it has a third-order intercept point of –15 dBm and a noise figure of 5.0 dB, measured at 45 MHz. Internal 1.5-kΩ resistors facilitate a balanced transformer or a direct connection to crystal or ceramic filters.



Another IC, the model SA604, is a low-power fm intermediate-frequency system designed for high-performance, narrow-band fm applications. It features an intermediate-frequency amplifier, limiter, muting, data output, and quadrature detector. Its sensitivity is 0.27 μV for 50-Ω matched input; the component can be used for frequencies up to 10.7 MHz. Applications for the model SA604 include radio, communications receivers, and spectrum analyzers.

Both components are intended for portable battery applications and consume less than 2.5 mA. The model SA602 comes in an 8-pin small-outline or a dual in-line package, the model SA604 in a 16-pin small-outline package or a DIP. Available now, the components range in price from $2.66 to $6.56.

Signetics Corp., 811 East Arques Ave., P.O. Box 409, Sunnyvale, Calif. 94086.
Phone (408) 739-7700 [Circle 347]

Expander lets one I/O port be switched to 131 ports

The RS-232 Port Expander is an addition to a line of port expansion equipment. It can be used for communications complying with the RS-232-C or the International Telegraph and Telephone Consultative Committee's V.24 standards in uses where control is handled by asynchronous RS-232-C protocols, although synchronous protocols may be switched. While its predecessors' expansion capabilities were limited to 3, 5, or 7 port options, the Port Expander will allow one common input/output port to be switched to any one of up to 131 ports, says the manufacturer.

The RS-232 Port Expander, suited especially for use in automatic test and measurement applications, can reduce the incidence of broken cables. Also, used as an intelligent modem junction box at a number of remote sites, it serves to access and route data from a variety of multisource test ports for analysis at the central controlling site. Available three weeks after ordering, the Port Expander sells for $1,495.

Giltronix Corp., 3780 Fabian Way, Palo Alto, Calif. 94303.
Phone (415) 493-1300 [Circle 349]

Rf amplifier produces 80 W from 200 MHz to 900 MHz

A solid-state radio-frequency amplifier produces a minimum of 80 W throughout a bandwidth of 200 MHz to 900 MHz and a minimum of 70 W to 1,000 MHz. A newcomer to the W series, the model 80W1000M1 supplies additional power-output capability to a line of 1-W, 5-W, 10-W, 50-W, and 80-W amplifiers operating in the band from 100 to 1,000 MHz.

The minimum continuous wave linear output of the model 80W1000M1 is 50 W from 200 to 1,000 MHz. Its maximum power output is 150 W. The amplifier supplies 48 dB minimum gain with a typical flatness of ±0.5 dB, or ±2.0 dB maximum. Its bandwidth is available instantly, without bandswitching or tuning, and it performs with unconditional stability, the company says.

Harmonic distortion is not less than 20 dB below fundamental at 50-W output, and intermodulation distor-

tion, specified by the third-order intercept, is typically 59 dBm. The primary power required is 115/230 V ac, 50/60 Hz, and 2,100 W.

Priced at $36,000, the model 80W1000M1 can be delivered within 90 days.

Amplifier Research, 160 School House Rd., Souderton, Penn. 18964.
Phone (215) 723-8181 [Circle 348]

Unit prints 200 characters/s, acts as receive-only terminal

Two dot-matrix printers operate at a speed of 200 characters/s in a straight burst with an average print speed of 150 characters/s. The model 5310 is a 16-lb portable printer, while the model 5320 has a wide paper-handling mechanism for spreadsheet-like applications.

When the keyboard is removed, either printer becomes a receive-only terminal that can work as an adjunct to other equipment, including the company's terminals and processors equipped with RS-232-C interface ports. As terminals, the units can operate at line speeds from 110 to 9,600 bits/s, asynchronous or isochronous, using an ASCII asynchronous or the ANSI 3.64 format. An optional dialing modem can be mounted in card slots in the printer housing.

The printers have a skip-space feature that, when they are used as terminals, recognizes three or more spaces and jumps to the next character. Both models also sport a 1,024-character line buffer that allows the bidirectional printing mechanism to catch up to data received on a higher-speed line input port.

The printers can turn out picture-prints, maps, circles, three-dimensional designs, and other elaborate patterns. Also, both units print the 96-character ASCII set, APL programming language and securities symbols, and line drawing and mosaic symbols.

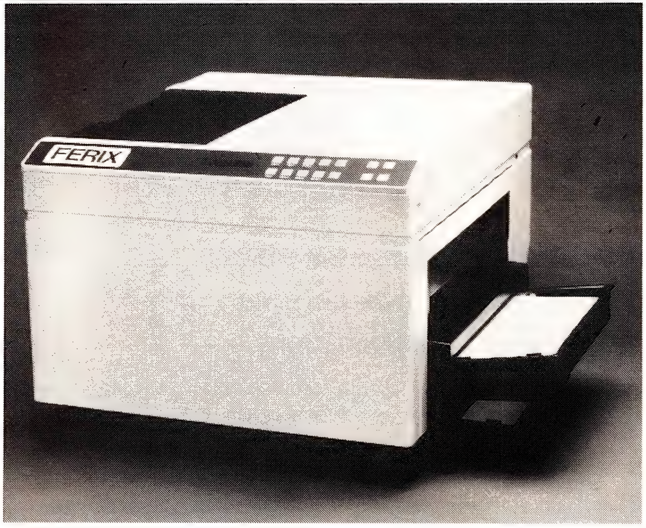
Available now, the teleprinters sell for between $1,295 and $2,515 per unit, depending on options.

AT&T Information Systems, 100 Southgate Pkwy., Morristown, N.J. 07960.
Phone (800) 247-1212 [Circle 355]

Printer's sharp images result from thin-film recording head

Based on a patented thin-film recording head, a nonimpact magnetic printer operates at 10 pages/min. and is designed for offices turning out 2,000 to 10,000 pages/month. The desktop model 800 can store images on its magnetic drum; once an image has been created, it can be used indefinitely in a duplicator mode that prints 14 pages/min.

The thin-film magnetic head has an internal coil structure surrounded by magnetic material, unlike ring-core heads, in which coils are wrapped around magnetic materials. This internal coil structure reportedly eliminates interference between adjacent head elements and produces distinct magnetic boundaries, resulting in sharp images.



The model 800 uses an array of magnetic head elements mounted in a flexible substrate to generate 57,600-dot images/in.^{2} on a magnetically coated drum. As the drum rotates, it comes in contact with dry, monocomponent toner that adheres to the latent magnetic images. It then transfers and heat-fuses these developed images to ordinary paper.

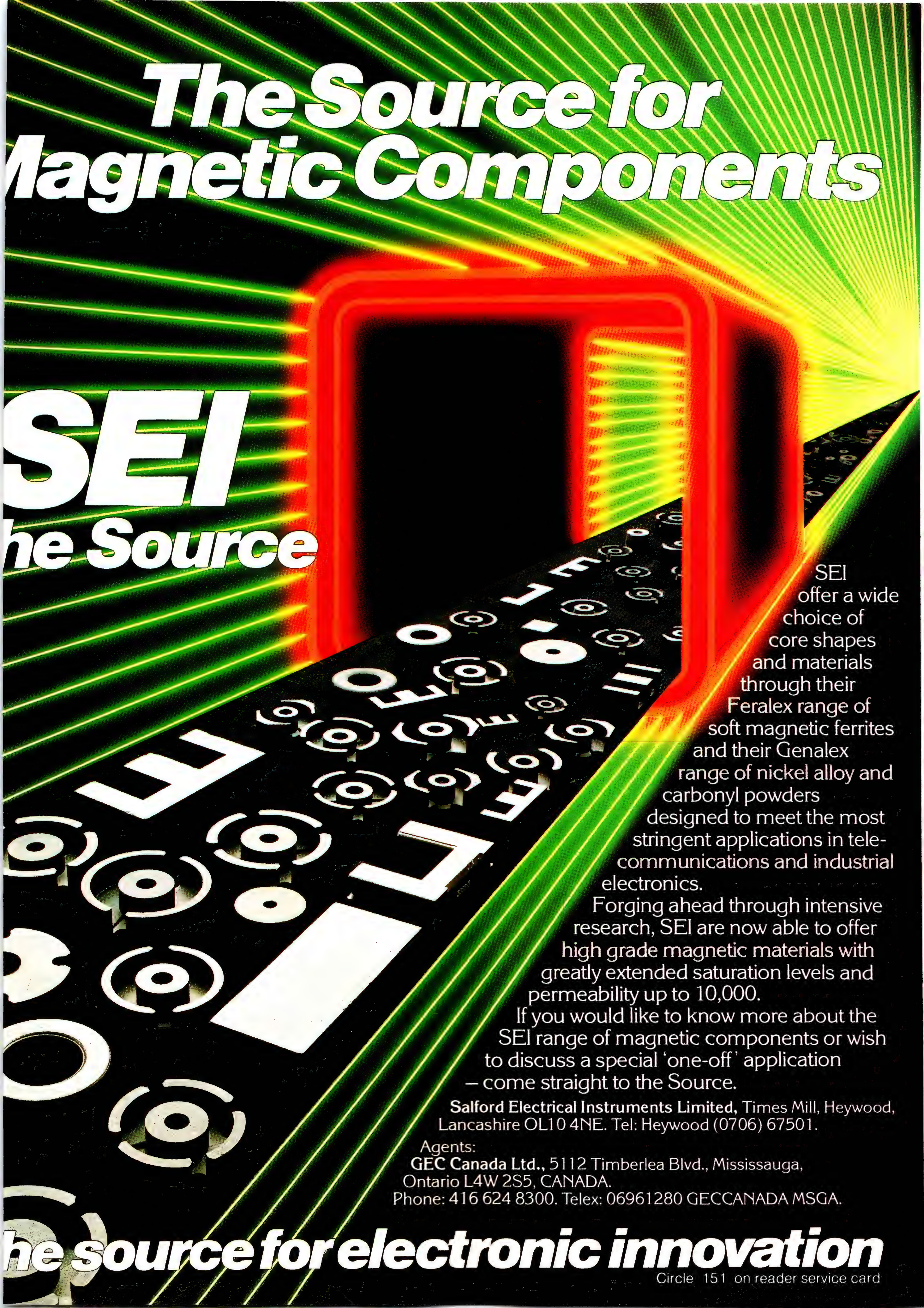
Initially, the model 800 will be marketed exclusively to original-equipment manufacturers and distributors, and will range in price from $2,000 to $3,000, depending on options and size of order.

Ferix Corp., 48571 Milmont Dr., Fremont, Calif. 94538. Phone (415) 659-0800 [Circle 354]

Programmer comes equipped to burn in over 120 EPROMs

Using intelligent algorithms and electronic device identification, the model 21A programs over 120 erasable programmable read-only memories and electrically erasable PROMs of up to 256-K, incorporates a data editor, comes standard with remote-control software, and offers front-panel entry of data-transfer functions such as baud rate and parity. The manufacturer says that diverse capabilities make the model 21A desirable for MOS-memories users with wide-ranging programming needs.

The 21A, which sells for $1,450, has comprehensive self-testing and chip testing. A self-diagnostic routine checks the internal random-access memory and ROM,



SEI offer a wide choice of core shapes and materials through their Feralex range of soft magnetic ferrites and their Genalex range of nickel alloy and carbonyl powders designed to meet the most stringent applications in telecommunications and industrial electronics.

Forging ahead through intensive research, SEI are now able to offer high grade magnetic materials with greatly extended saturation levels and permeability up to 10,000.

If you would like to know more about the SEI range of magnetic components or wish to discuss a special 'one-off' application – come straight to the Source.

Salford Electrical Instruments Limited, Times Mill, Heywood,
Lancashire OL10 4NE. Tel: Heywood (0706) 67501.

Agents:
GEC Canada Ltd., 5112 Timberlea Blvd., Mississauga,
Ontario L4W 2S5, CANADA.
Phone: 416 624 8300. Telex: 06961280 GECCANADA MSGA.

Circle 151 on reader service card

front-panel display, microprocessor, and serial input/output port. Other features include 32-K-by-8-bit data RAM and RS-232-C interface. Delivery takes two weeks.

Data I/O Corp., 10525 Willows Rd. N.E., P.O. Box 97046, Redmond, Wash. 98073.
Phone (206) 881-6444 [Circle 370]

With board, IBM PC users can write real-time programs

When the model PC/VRTX board is added to an IBM Corp. Personal Computer, a programmer can use the PC to write real-time programs in high-level languages. Plugged into an empty IBM PC slot, the board concurrently manages and processes all tasks associated with the execution and performance of the user's application programs. Up to 256 interactive or nonrelated tasks can be processed at once, taking only 250 μs to switch from one task to another.

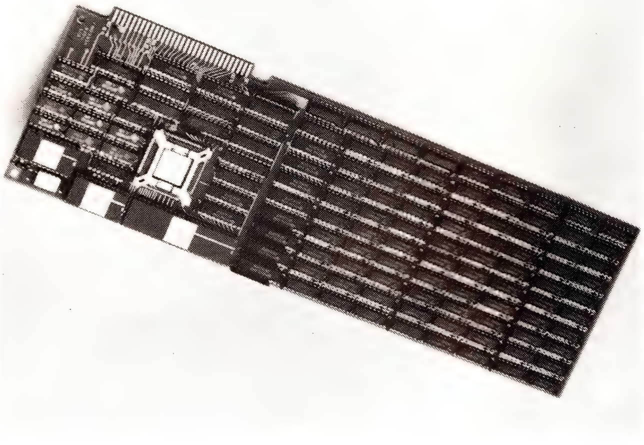
The model PC/VRTX supports the PC-DOS along with its real-time operating system, so that users can access BIOS functions and perform DOS operations as tasks running under VRTX. Along with retaining DOS's range of utility and application programs, this capability reduces the amount of programming needed to support and manage PC peripherals such as hard and floppy disks, parallel and serial interfaces, and real-time clocks.

Available in 30 days, the model PC/VRTX sells for $1,495 and comes with a software package that includes utilities, function calls, preprocess programs, and high-level language interface libraries.

Dyad Technology Corp., 4040-G Sorrento Valley Blvd., San Diego, Calif. 92121.
Phone (619) 450-1761 [Circle 350]

Coprocessor for PC XT has 6- or 10-MHz CPU

An add-on coprocessor for the IBM Corp. PC XT and plug-compatible computers occupies a single expansion slot. The Tiger-32 sports a 6- or 10-MHz 32032 or 32016 central processing unit with timing control, virtual-memory management, and floating-point math units, along with 512-K bytes to 2 megabytes of dual-ported memory.



It comes with the Xenix operating system, C and Assembly language, and supporting installation and interfacing software. While Xenix is running, the Tiger-32 uses the PC with PC-DOS/MS-DOS 1.1 as an input/output processor. The Tiger-32 can function as expansion memory or as a random-access-memory disk; the Tiger CPU and I/O processor can access the RAM independently. Other operating systems can be ported to the Tiger-32, or developers can use the hardware with software of their own choosing.

Single quantities of the Tiger-32 will be available in November. With Xenix and 512-K of RAM, it will sell for $2,495. Volume deliveries will start in January.

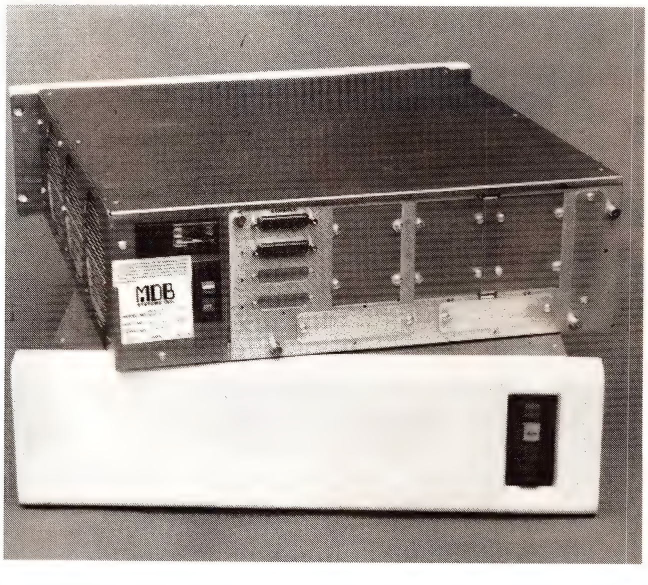
DFE Electronic Data Systems, 1250 Oakmead Pkwy., Suite 210, P.O. Box 3599, Sunnyvale, Calif. 94088. Phone (408) 730-2652 [Circle 351]

Q-bus boxes facilitate building of compact systems

Intended for systems integrators and end-users, a line of Q-bus basic box systems permits front or rear loading. Each system includes a Digital Equipment Corp. 11/12 Plus central processing unit and the company's 800 series chassis and memory modules with 256-K or 512-K bytes on dual-sized boards. A 1-megabyte memory module on a quad-sized board is also available.

The rear cable distribution panel allows the use of DEC cable kits and modules or the company's series of interface modules. The layout of the basic system and cable distribution panel allows integrators to develop flexible, compact systems using DEC's or the company's modules, while still complying with Federal Communications Commission regulations for electromagnetic and radio-frequency interference.

For example, a 5¼-in.-high chassis made by the company can contain an 11/23 Plus CPU, 1.5 megabytes of memory, 32 DZ11-compatible multiplexer ports, a storage-module-drive controller, and a line-printer controller—all using connectors mounted on the rear distribu-



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tion panel. Prices of the systems, available now, start at $4,545.

MDB Systems Inc., 1995 N. Batavia St., Box 5508, Orange, Calif. 92267. Phone (714) 998-6900 [Circle 352]

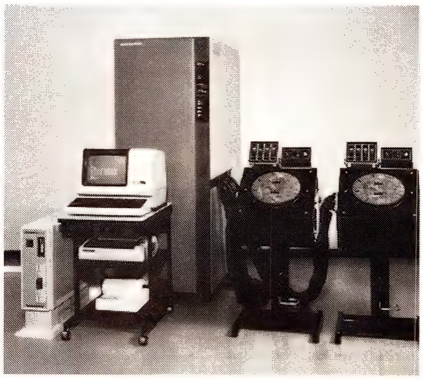
System tests RAMS, DRAMs, SRAMs, EEPROMs in parallel

Using eight high-speed parametric measurement units, the model 9400 tests 1-Mb dynamic random-access memories, high-speed static RAMs, erasable programmable read-only memories, and electrically erasable PROMs in parallel, without compromising clocking or timing flexibility, the firm says. The system uses up to 12 power supplies per test head; all patterns run at speeds up to 25 MHz.

With its 9-bit-wide failed bit map, a flexible timing system, and either a one-window or dual-edge strobes, the system can also be used as an engineering test system. Its small test head facilitates mounting to a handler and prober, along with prober communication through either an IEEE-488 or RS-232-C interface.

Priced at $250,000, the system is available in 14 weeks.

Mitsui and Co. Inc., 563 Commerce St., Franklin Lakes, N.J. 07417.
Phone (201) 337-1300 [Circle 353]



Humidity-sensor chip is linear to within 2%

A humidity chip that offers an extended range of applications, the Ultra-H, is claimed by the manufacturer to be the sensor of choice for environments with a wide temperature range (from –50°C to +120°C) and under conditions where contamina-

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Germany Bitronic, Munich 60 01 05   Japan Internix, Tokyo 369-1101

Elantec, Inc., 1996 Tarob Court, Milpitas, California 95035, (408) 945-1323
Outside California Call Toll Free (800) 821-7429

tion is high. The Ultra-H is also said to offer high accuracy (including linearity and hysteresis of ±2%) and fast performance (a nominal time constant of 10 s).

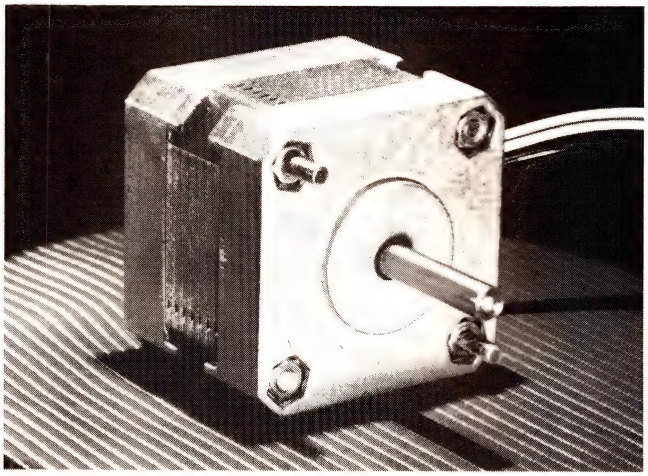
The system is provided with a two-wire 4-to-20-mA transmitter calibrated for the full relative humidity range from 0 to 100%. Noninteracting zero and span adjustments make calibration easy. Solvents, surface contamination, and condensation present no problem because the capacitive field is restricted to within the thickness of the humidity-absorbing dielectric coating. Price was unavailable at press time.

Hy-Cal Engineering, 9650 Telstar Avenue, El Monte, Calif. 91731.
Phone (818) 444-4000 [Circle 366]

12-V motor boasts running torque of 45 oz-in.

Designers of peripherals and medical instrumentation will be interested in a hybrid stepper motor for which the manufacturer claims highly accurate rotary positioning. The series 4SQ motor features a holding torque of 9.2 oz-in., running torque up to 45 oz-in., and operating speeds above 3,200 steps/s.

Its operating voltage is 12 V dc. Options available include rear-shaft extension, steel end bells, and monofilar coils.

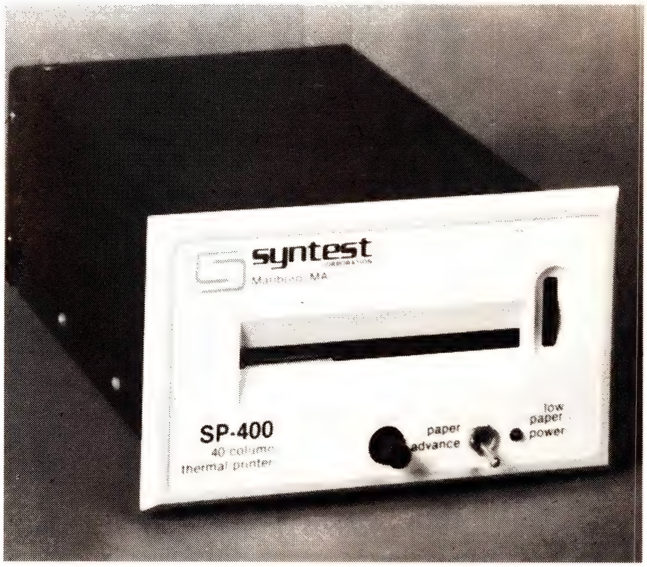


Delivery of prototypes can be made within two to four weeks, while production orders require from 10 to 12 weeks. In quantities of 500, the motor is priced at $10.95 each.

Airpax Corp., P.O. Box 868, Cheshire, Conn. 06410. Phone (203) 272-0301 [Circle 367]

Small 40-column printer fits in industrial gear

A matrix printer that is small enough (8 by 4.45 by 2.7 in.) to be built into equipment, the SP-400 alphanumeric printer, provides a 40-column printout on thermal paper. It has switch-selectable baud rates of 50 to 9,600 baud, and selectable stop bits and parity. Input is standard RS-232-C or 20-mA loop. A 40-character buffer is standard. Printing speed is one line/s. Standard 12-V dc input power allows use with vehicle communications or computers. The printer comes with a light-emitting-diode display that blinks to indicate paper is running out.



Available from stock, delivery may take up to 30 days. The price, which includes a 115-V ac power supply, is $365 for a single piece, $285 in original-equipment manufacturer quantities.

Syntest, 40 Locke Dr., Marlboro, Mass. 01752.
Phone (617) 481-7827 [Circle 368]

Terminal comes equipped with emulation protocols

The basic version of the Miracle, an IBM 3178-compatible terminal, can be upgraded with optional multihost communication. The unit is intended for the IBM 3270 and ASCII user who needs to access more than one make of host computer. The Miracle is offered with multicommunications support for DEC, character, and block mode ASCII emulators, in addition to IBM 3278 model 5, 132-character screen formats. The manufacturer claims that the terminal's communications protocols al-

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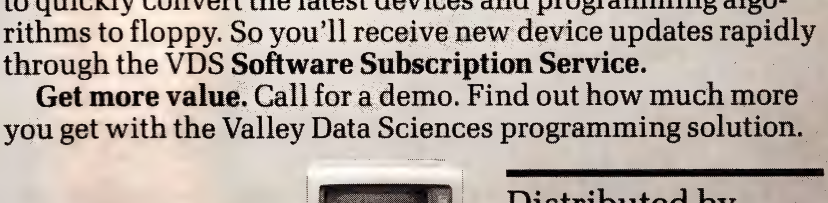

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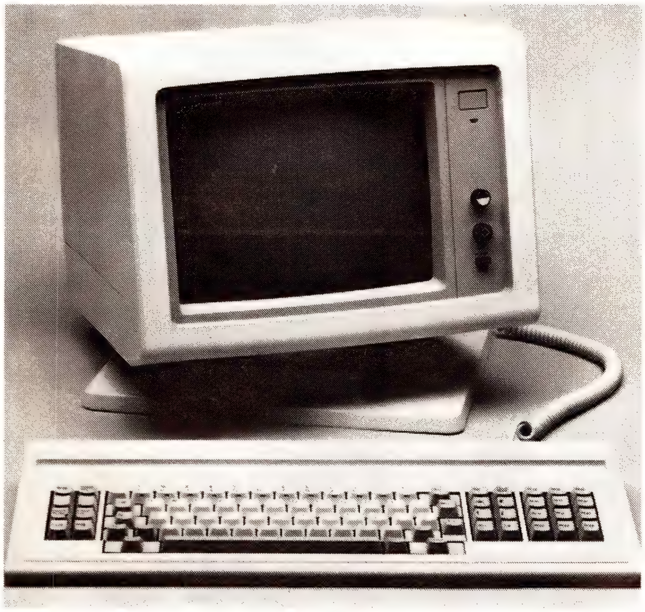

low interfacing with almost 70% of mainframes on the market. The system can be switched from one mainframe to another without losing information.

Units are now being shipped. The price, $995, is claimed to be a breakthrough in the market for IBM-compatible single-unit terminals.

Term-Tronics Inc., 7408 Trade St., San Diego, Calif. 92121. Phone (619) 271-1770 in California, (800) 821-8376 elsewhere [Circle 363]

Switch eliminates need to detach peripheral cables

A two-position data transfer switch, the series 824, is used in computer systems to switch one RS-232-C input between two outputs, or one output between two inputs. In applications where such switching is not software controlled, the series 824 will eliminate the inconvenience of disconnecting cables when changing from one RS-232-C peripheral to another. Several switches may be interconnected to foster versatility.

The series 824 is a fully shielded enclosure and has connectors for electromagnetic control, interconnections made with a one-piece flexible circuit, and gold-flashed connector contacts with silver-plated switch contacts to ensure reliability.

Priced at $80 each in production quantities, the series 824 is available within 10 weeks.

CTS Corp., Paso Robles Division, 500 Linne Rd., Paso Robles, Calif. 93446. Phone (805) 238-0350 [Circle 380]

12-in. amber monitor sells for $159 each

An amber monitor that is compatible with most personal computers, according to the manufacturer, features a composite video input signal and a 2,000-character display. The model SA-1000 offers a resolution of 900 dots center and 800 dots corner on a 12-in. viewing area. The unit is now ready for delivery. It carries a retail price of $159.

Sakata USA Corp., 651 Bonnie La., Elk Grove Village, Ill. 60007 [Circle 362]

200-W multiple-output supply targets telecommunications

The telecommunications industry is being offered a 200-W multiple-output power supply, the model 1110. It is claimed by the manufacturer to be the first dc-to-dc converter that employs magnetic saturable reactor regulation in both the main as well as auxiliary outputs.

With an input range of 40 to 70 V dc (48 V dc nominal), the model 1110 delivers 5 V at 20 A, ±12 V at 4 A, and –5 V at 0.5 A. The secondary outputs are adjustable to ±15 V at 3 A.

The model 1110 comes in a package measuring 2.7 by 5.25 by 11 in. All outputs are current limited and have continuous-overload and short-circuit protection. Overtemperature protection is also provided. Self-recovering overvoltage protection is provided on the +5-V output. Other models are available in the 1100 series with surge capabilities for disk drives on both the +12-V and 24-V outputs. Single-piece pricing is $395 and delivery is from stock. Discounts to original-equipment manufacturers are available.

RO Associates Inc., 246 Caspian Dr., Sunnyvale, Calif. 94088. Phone (408) 744-1450 [Circle 365]

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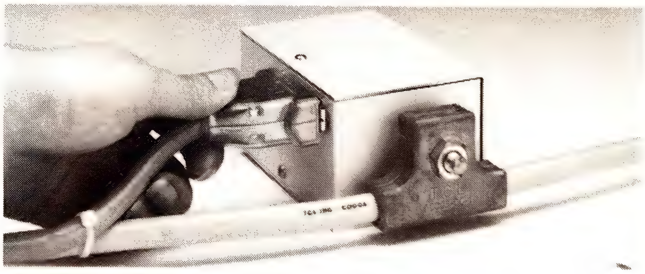
10 Mb/s transceiver meets IEEE-802.3 network specs

A transceiver medium attachment unit (MAU), the model 2010IS, meets the latest IEEE-802.3 local-network specifications for 10 Mb/s transmission rates. The transceiver/MAU complements the model 2010EBS transceiver, which is compatible with version 1.0 of Ethernet specifications.

Because of the way the subminiature D connector is mounted, the transceiver cable and the coaxial cable can be tied closely together. Thus it is possible to lock the



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1984 Issue dates.

October 15, 1984
December 15, 1984

1984 Closing dates.

September 15, 1984
November 15, 1984

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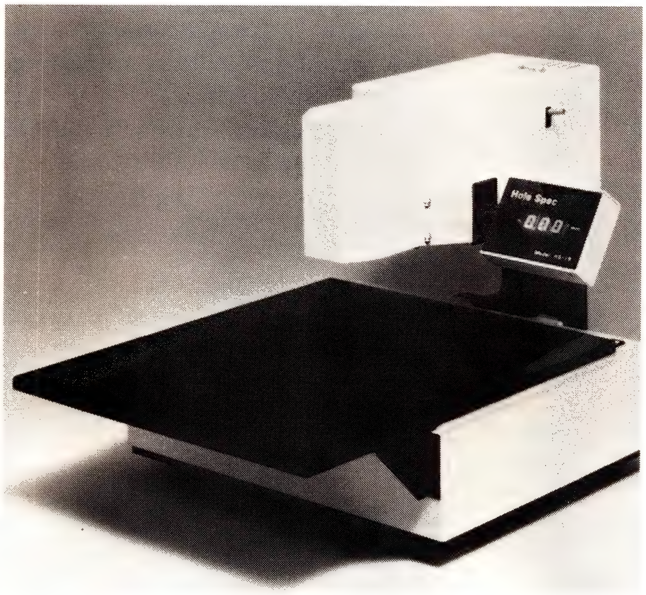
transceiver/MAU unit in a fixed position. The assembly is designed to fit 6-in. cable trays. The manufacturer claims that the model 2010IS is easily installed or relocated at any 2.5-m mark on the coaxial cable without disrupting the network.

Available now, the units sell for $232.80 each. Quantity discounts are available.

TCL Inc., 41829 Albrae St., Fremont, Calif., 94538.
Phone (415) 657-3800 [Circle 377]

Gauge for pc-board holes measures without damage

An optical measuring device, the Hole Spec, allows measurement of holes on printed-circuit boards without touching the material, eliminating the possibility of mechanical gauge damage. A digital readout is given in millimeters to three decimal places, with an accuracy of 25 μm, according to the manufacturer. The Hole Spec's lack of contact with the material contributes to its durability. Priced at $3,295, the Hole Spec is available eight weeks after ordering.



International Carbide Tool Inc., Kings Highway W., White River Junction, Vt. 05001.
Phone (802) 295-2537 [Circle 364]

System helps C programmers manage complex data bases

A data-base management system for software development in the C programming language consists of a data-definition language processor and a library of C functions. With db-Vista, C programmers can define and manage data bases regardless of the complexity of the information structuring requirements.

The system is an implementation of the network data base model, using a B*-tree for key field indexing. The multiple key record feature allows all data fields to be keys. Records are of fixed length, for fast managment of data-base storage and the reuse of deleted record slots. The db-Vista package currently requires PC-DOS or MS-DOS version 2, 128-K bytes of memory, and a 320-K-byte floppy disk drive. The DBMS sells for $495; an unlimited run-time distribution license is priced at $795. The package includes three months of applications support and product updates.

PC-Write, a word processor/text editor, is also provided. It will be available soon under AT&T's Unix operating system for the Fortune 32:16 and under the Xenix operating system for the Altos 586 computer system.

Raima Corp., 11717 Rainier Ave. S., Seattle, Wash. 98178. Phone (206) 772-1515 [Circle 340]

Enhanced Cobol debugger has faster execution rate

An interactive testing and debugging tool for Cobol programs, XPF/Cobol, has been enhanced with features that include increased speed in execution, reduced storage requirements, new control commands, and compatibility with IBM Corp.'s VS Cobol II compiler.

With release 1.1.0 of XPF/Cobol, programmers can speed development by monitoring and correcting programs at their terminals, using full-screen menus and help panels modeled after IBM's Interactive System Productivity Facility. Program execution speed has been doubled with release 1.1.0, and by executing a Speed command, users can test and amend code 10 times faster than with the previous release, the company says.

A facility called session log records activities of the debugging system, which can be reviewed by the user. Listed in the session log are the session number, user and program identification, a trace display, all input commands, and the reasons for program interceptions.

Another command lets the programmer view all statement numbers and paragraph names that have been executed in full screen. XPF/Cobol is available now for a license fee of $30,000 for the first processing unit.

Boole and Babbage Inc., World Headquarters, 510 Oakmead Pkwy., Sunnyvale, Calif. 94086.
Phone (408) 735-9550 [Circle 341]

Interface eases access to complex Unix programs

A full-screen interface, the SoftShell, gives users direct access to even the most complex programs and packages available with the AT&T Bell Laboratories Unix operating system. While SoftShell simplifies the use of Unix's hierarchical file and command structure, it fully retains the system's capabilities.

Intended for users at all levels of expertise, SoftShell provides templates to facilitate the choosing of options for all major commands, a structured "walk" to traverse the layers of the Unix file system, and context information to keep users oriented at all times. It also serves as a screen handler and menu driver.

SoftShell divides the terminal's screen into two parts,

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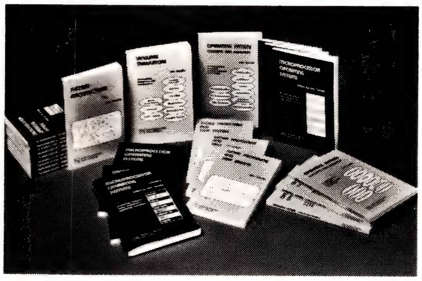

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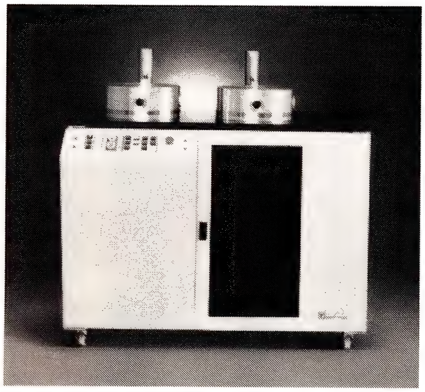
the window and the scroll. The size of the window varies with the space needed by the SoftShell command or template. If the desired Unix command is known, the information can be entered directly into the scroll. If the command is known, but not its arguments, the user can invoke a command template that appears in the window to prompt him for the proper parameters and options through fill-in-the-blank fields, toggles, and descriptive information. License fees for binary copies of SoftShell, which runs on many versions of Unix, range from $295 to $995 for each copy, depending on the central processing unit.

Logical Software Inc., 17 Auburn St., Cambridge, Mass. 02138. Phone (617) 864-0137

[Circle 339]

Plasma-processing systems suitable for small-scale work do etching, deposition

Designed primarily for pilot-scale manufacturing, gallium-arsenide- and silicon-processing laboratories, and device failure analysis, the series 500 Waf'r/Batch systems are suitable for reactive ion etching, plasma etch, and deposition processes. Chambers are 14 in. in diameter and accommodate up to five 4-in. wafers. GaAs can be etched at up to 5 μm/min.



System options feature modular components, mass flow control, and auto pressure control, as well as a nitrogen purge capability for all process gases. The process chamber can be configured with center or side pumping and is available with a hood/glove box that can be nitrogen purged to avoid contamination. Other features include capacitance manometer pressure measurement, solid-state 13.56-MHz radio-frequency generators, a 165 ft^3/min blower package, and a one-piece chamber wall for leak-free operation.

Also featured is the model 520/530 dual-chamber unit, which permits each chamber to be configured for plasma etch or deposition or reactive ion etch.

Price for the series 500 starts at $45,000. Delivery usually takes 8 to 10 weeks from receipt of order, according to the company.

Plasma Therm Inc., Standard Systems Division, Rte. 73, Kresson, N.J. 08053.
Phone (609) 767-6120 [Circle 358]

Laser system aids engineers in developing VLSI memories

A mechanized laser system, the model 31, aids failure analysts in circuit isolation by cutting metal lines on very large-scale integrated circuits and assists engineers making redundant-memory repairs. The model 31 can be upgraded for automation under either the company's system controller or others that use an IEEE-488 bus.

Using the model 31, the operator can cut and probe simultaneously because a variety of probe stations can

be used with it, including Alessi, Micromanipulator, and Signatone. For VLSI redundant-memory research and development, the system is also compatible with wafer probes such as Electroglas, Pacific Western, and Rucker and Kolls.

The system guarantees 3-μm laser cuts on aluminum, gold, and polysilicon, passivated or unpassivated, and a motorized laser-beam positioning of 0.4 μm over a 2-by-2-in. X and Y axes area. Z axis motion is adjustable over a 1-in. range, also accurate to within 1-μm resolution. Available within 120 days, the model 31 sells for $65,000. With the company's model LFA probe station, it sells for $73,500.

Florod Corp., 3341 W. El Segundo Blvd., Hawthorne, Calif. 90250. Phone (213) 679-8201 [Circle 359]

Trackball provides three axes for medical equipment

A three-axis trackball, the T500, provides systems with an X, Y, and user-definable third axis, which can be used for the rotation of three-dimensional figures as well as for zoom. This flexible third axis makes the T500 a particularly advanced piece of equipment for medical instruments such as magnetic-resonant and computer-axial-tomography scanners. Other applications include process control, graphics, air-traffic control, flight simulation, and robotic control.

The T500, which is a redesigned version of the company's two-axis model, is available now, with RS-232-C or quadrature outputs. The three-axis trackball sells for $1,200

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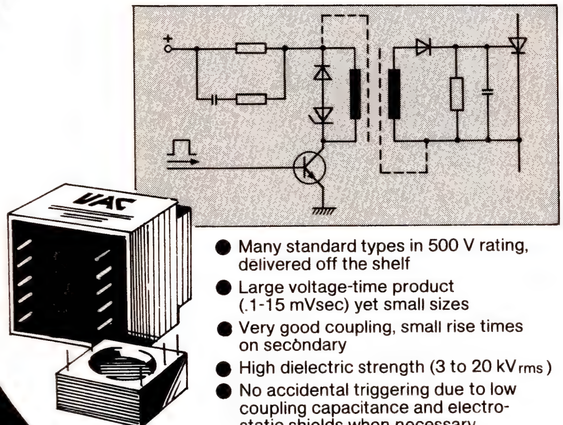

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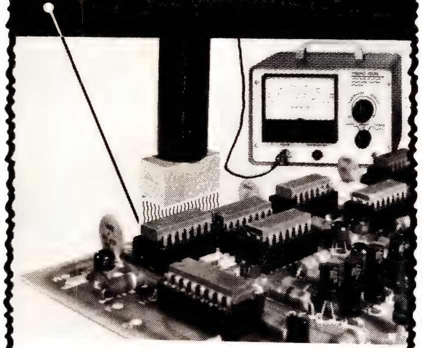

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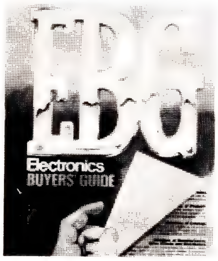

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Disc Instruments, 102 E. Baker St., Costa Mesa, Calif. 92626.
Phone (714) 979-5300 [Circle 373]

3-d puck is adjustable to fit on any keyboard

The three-dimensional puck pointer may be of special interest to the word-processing and interactive-graphics industries. This three-axis part can provide up to 1,000 points of X, Y, and Z resolution, with a noncontact switch built in. The actuating member is a simple part resembling a standard key top, and it may be customized to fit any housing or keyboard. The active element can be mounted on a printed-circuit board and is 0.45 in. high. The 3-d puck pointer, for which patents are pending, has a lifetime in excess of 10 million cycles under normal use, according to the manufacturer.

Shipment will be made 90 days after receipt of order. The equipment is priced to original-equipment manufacturers at $15 in quantities of 10,000.

KA Design Group, 6300 Telegraph Ave., Oakland, Calif. 94609.
Phone (415) 654-6300 [Circle 372]

Soldering iron serves surface-mounted devices

A soldering iron, the Soldermaster SMD, designed for soldering, desoldering, and replacing surface-mounted devices, has a short reach designed for precise positioning on fine-line circuitry. A hatchet-model SMDH 10 is intended for applications "under the microscope," for high-density boards.

Miniature tips are available for soldering both dual in-line leads and leadless packages. Slotted spade tips are also available, for soldering and desoldering leadless packages and chip resistors or capacitors.

A thermal compensating element increases the output of the iron as the work rate increases. Various idle temperatures and custom tips for special applications are available on request. Priced at $20.40, the iron is available now from distributors' stock.

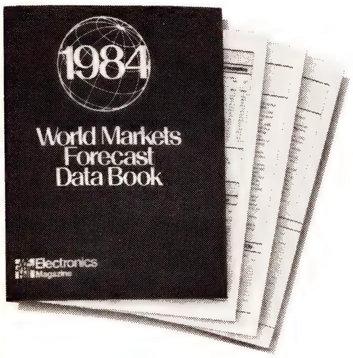
Hexacon Electric Co., P.O. Box 36, 161 W. Clay Ave., Roselle Park, N.J. 07204.
Phone (201) 245-6200 [Circle 376]

Fortran-77 compiler runs on DEC PDP-11 computers

An implementation of Fortran-77 is intended for use with the company's Professional 350 personal computer and PDP-11 computers. Running under the RT-11 operating system, F77-RT-11 is the same Fortran-77 compiler running under the RSX and RSTS operating systems.

Highly compatible with VAX Fortran, F77-RT-11 suits scientific and university environments. Typical applications include the development and execution of analytical programs in a variety of disciplines. Among its features are complete support of double precision and complex arithmetic,

Market Profile



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virtual arrays, encode/decode statements, and dynamic run-time format capability, as well as free-format input/output.

The compiler runs under Version 5 or 5.1 of RT-11 on any PDP-11 or Professional 350 configuration that includes at least 48-K bytes of user memory, 1 megabyte of available disk space, and a floating-point processor.

F77-RT-11 is available through the company's software library and is priced from $950; deliveries take 30 days.

Digital Equipment Corp., Maynard, Mass. 01754.
Phone (617) 897-5111 [Circle 356]

Robotic screwdrivers have up to 39 lb-in.

Six electronic screwdrivers with controlled torque are available for use with automated assembly or robotics equipment. They are used in conjunction with a power source and a machine controller to drive or remove fasteners. Torque ranges from 1.1 to 39.0 lb-in., and torques are adjustable. Torque repeatability is ±1.5%. The manufacturer states that their best use is with delicate plastics or miniature assemblies.

Priced at about $1,500 for the end-of-arm add-on screwdrivers and the required transformer, the parts are available from stock.

Jergens Inc., 19520 Nottingham Rd., Cleveland, Ohio 44110.
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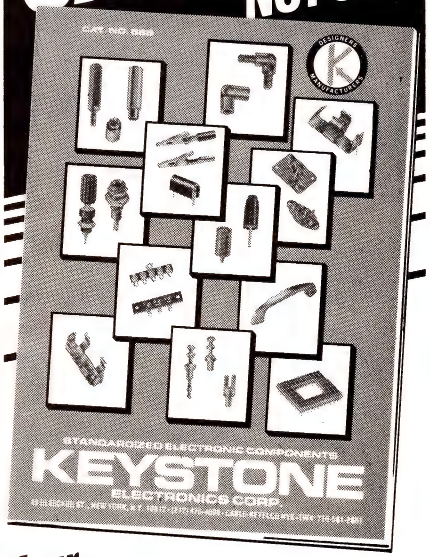

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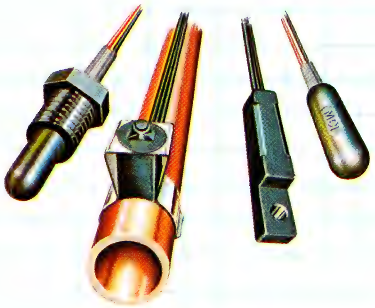

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paper. The manufacturer states that the industry standard for storing drawings is aperture cards and that the work station combines the editing features of automated design equipment with the flexibility of automated records systems.

The work station consists of an aperture-card scanner, a high-resolution display terminal, 68000 and IBM PC XT processors, and a high-speed laser printer. A graphics symbol library is also offered. Orders are being accepted, with shipments to begin in January 1985. Depending on configuration, the work station sells for from $63,000 to $98,000.

Tera Corp., 2150 Shattuck Ave., Berkeley, Calif. 94704.
Phone (415) 845-5200 [Circle 369]

Unix-based system allows 32 computers to communicate with a variety of IBM hosts

Operating under AT&T Bell Laboratories' Unix System III and V, UniPATH lets as many as 32 computers communicate with a variety of IBM hosts on Systems Network Architecture/Synchronous Data Link Control and Bisynchronous networks. Available now, UniPATH requires 256-K bytes of memory and offers concurrent emulation of 3270, 3770, 3780, and 2780 machines.

UniPATH includes modularized software components, facilitating simple porting to various Unix and Unix-compatible operating systems. The modular software will operate as a logical extension of Unix, transparently managing address translation and logical unit identification for smooth communications and multitasking.

The products offer the ability to maintain a communications session while executing a local application, multiple concurrent print support, data capture, and retrieval, as well as interfacing to a variety of applications software.

Although pricing for UniPATH has not yet been established, it is estimated to be in the $1,000 range, regardless of the number of users that it will support. Discounts will be available to original-equipment manufacturers.

Pathway Design Inc., 177 Worcester St., Wellesley, Mass. 02181.
Phone (617) 237-7722 [Circle 360]

Fiber-optic modem priced at $149 reaches 56 kbaud with handshaking

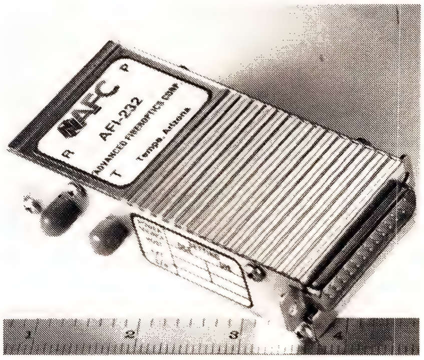
An expanded series of fiber-optic RS-232-C modems, the AFI-232 series, provide full-duplex asynchronous communication at rates above 56 kbaud, and half-duplex operations with handshaking capability. The units are configurable for either host-supplied or external power.

The noise-immune transmission medium provides data security without encryption. An optical range greater than 30 dB permits short-length operation without saturation. Handshaking uses an on/off protocol or goes by way of standard RS-232-C control signals. The units are compatible with data-terminal and and data-communications equipment.

Two models are available with subminiature type-A connectors and two with Optimate connectors. All are designed for short-distance connections (up to 100 meters) with plastic cable or long-distance connections (up to several kilometers) with glass fiber. The manufacturer also provides cable termination service and kits.

The AFI-232 modems are available now, starting at $149.

Advanced Fiberoptics Corp., 637 S. Hayden Rd., Tempe, Ariz. 85281.
Phone (602) 966-0323 [Circle 375]



Letters

Cooperation eases tensions

To the editor: As a subscriber to *Electronics* since it was founded, and as one of the members of the Institute of Radio Engineers (now IEEE) who was invited to give two technical papers at the International Electronics Conference of the Popov Society in the spring of 1959, I believe that it is unfortunate that in an *ElectronicsWeek* editorial ["The IEEE would do well to reject Soviet deals," July 30, 1984, p. 72] the statement was made that the IEEE should reject a petition of the Soviet Union's A.S. Popov Society to reestablish a technical exchange between the two organizations.

It seems to me that when there is so much tension between the two nations, both of which are involved in an arms race, there is a great need for the development of better understanding between their engineers and scientists in order to minimize the outbreak of military conflict with all of its dangers to this planet.

Based on my experience in Moscow during the 1959 conference, exchange of information was two-way. This provided an opportunity for the engineers from the U.S. to acquire much information relating to the state of the art in the USSR, and for their engineers and those from other countries to know about technical developments that were pioneered in the U.S.

Since technical publications in the U.S., such as *ElectronicsWeek* magazine, were widely distributed throughout the USSR in libraries and other sources, Soviet engineers and scientists get much more information from these publications than from occasional technical conferences between the two countries. Both sides benefit, and from a human relations viewpoint, gain a better understanding of each other—of importance in today's world.

William S. Halstead
Chairman
Unitel International TV Foundation

Memorex tune-up

To the editor: There was an error associated with Memorex in the People section ["Amcodyne's Earhart foresees big future in removable hard disks," Aug. 13, 1984, p. 37].

The article states that Memorex was "eventually purchased by Tandy Corp." To clear up any confusion, Memorex sold only its relatively small Consumer Products Division to Tandy Corp., in the second quarter of 1981.

In December 1981, Memorex became a free-standing subsidiary of Burroughs Corp. Memorex manufactures and markets information storage equipment, communications equipment, and computer media.

Lani Ulbrich
Internal Communications Specialist
Memorex Corporation
Santa Clara, Calif.

Bloch to the rescue?

To the Editor: I share your cautious optimism at the appointment of Erich Bloch to head the National Science Foundation ["The NSF is going to get an EE as its director," July 12, 1984, p. 24]. In the recent past, Bloch has said that there is no shortage of engineers. It will be interesting to see if he will be forced to succumb to the interests of the academic establishment that runs the NSF.

Bloch will have to correct the NSF's deplorable tendency to award large grants to such organizations as the American Association for the Advancement of Science. Most important of all, Bloch must correct the increasingly widespread impression that the NSF exists for the sole purpose of transfering money from the pockets of the taxpayers to those of professors.

Irwin Feerst
Committee of Concerned EEs
Massapequa Park, N.Y.

Corrections

In "Satellite makers fear competition from space shuttle" (May 31, 1984, p. 65), the commercial satellite launches discussed should have been identified as expendable launch vehicles. Also, the system described in "CAD system coordinates complete semicustom chip design" (June 16, 1984, p. 116), was developed with the U.S. Army's research and development command.

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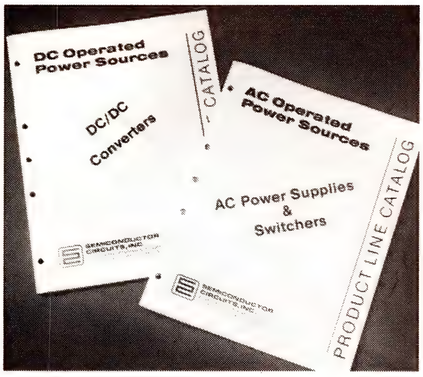
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To switch or not. A 60-page power-source selection guide describes line-operated linear and switch-mode power supplies as well as dc-to-dc converters. The free catalog furnishes complete electrical and mechanical specifications for the more than 400 ac-to-dc and dc-to-dc models that make up the company's standard product line. Included is an eight-page quick look-up section that directs readers to the product pages that cover their power-source requirements. For a copy, call (603) 893-2330 or write to Semiconductor Circuits Inc., 49 Range Rd., Windham, N.H. 03087. [Circle reader service number 421]

The answer please. Since the Federal Communications Commission emissions specifications went into full effect last year, interference reduction has become a major concern to manufacturers. A free brochure titled *Eight Short Questions and Answers* attempts to explain the basics of the FCC's requirements on electromagnetic interference. Copies are available by calling (813) 544-2594 or writing to TKC Publications, 8609 66th St. N., Pinellas Park, Fla. 33565. [Circle 422]

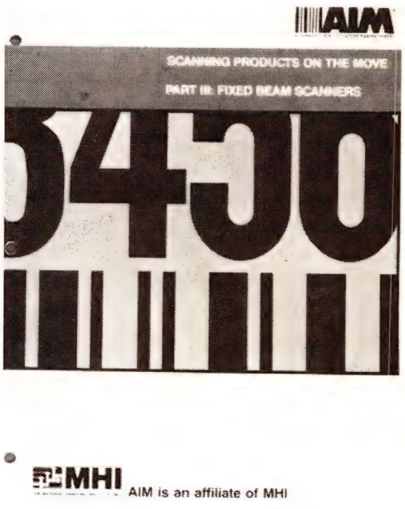
All aboard. A four-page application note discusses the operation of a MIL-STD-1553 bus monitor and the technical considerations involved in hardware designs of such a system. Titled *MIL-STD-1553 Bus Monitor,* the note defines a bus monitor and describes three major types—a passive data collector, a data collector and processor, and a failure detector for a back-up bus controller. It stresses the need for paying attention to the bus monitor's method of distinguishing between command words and status words. Two methods for designing a bus monitor are described. Copies of the note are available free of charge by writing to the Marketing Dept., ILC Data Device Corp., 105 Wilbur Pl., Bohemia, N.Y. 11716, or by calling (516) 567-5600. [Circle 423]

Receiver design. Parameters that should be considered when designing receiving systems, specifically noise figures, receiver sensitivity, third-order intercept level, and dynamic range, are discussed in application note No. 150. It describes in practical terms the relationships and trade-offs among those parameters. The application note directly addresses the task of selecting a pre-amplifier to be used at the input to a receiver. A free copy of the note can be had by calling (301) 667-0077 or by writing to Adams-Russell, Micro-Tel Division, 10713 Gilroy Rd., Hunt Valley, Md. 21030. [Circle 424]

Standard cells. A newslettter, *SCAN* (for standard cell application news) addresses the needs of designers and decision-makers who are using or considering using standard-cell technology in the design and manufacture of integrated circuits. Published every three weeks, the newsletter will provide information about current trends in the standard-cell design industry. The focus of *SCAN* is tutorial articles that aid the user or interested designer in the application of standard-cell design. Included in each issue is an article highlights section that offers a selection of pertinent reading material found in current trade publications. For more information, call (408) 262-9100 or write to International Microelectronic Products, 2830 North First St., San Jose, Calif. 95134. [Circle 427]

Keeping contact. A pair of newly released recommended standards from the Electronic Industries Association covers testing procedures for connectors. Standard RS-364-01A, *Acceleration Test Procedure for Electrical Connectors,* details a uniform test method for determining the ability of an electric connector to withstand a specified acceleration force without evidence of damage detrimental to its intended performance. The second recommended standard, publication RS-364-22A, is entitled *Life Test Procedure for Electrical Connectors.* The object of this recommended standard is to determine a connector's ability to perform in a prescribed manner in a given environment for the duration of a specified period. Copies of the recommended standards are available for $5 each from the Standards Sales Office, Electronic Industries Association, 2001 Eye St. N.W., Washington, D.C. 20006. [Circle 428]

Behind bars. Used in numerous material-handling applications to read bar codes, fixed-beam scanners are the subject of an educational brochure. The brochure features a comparison of fixed-beam scanners to other types of bar-code scanning equipment and also explains the two types of fixed-beam scanning systems: focused-beam illumination with broad-beam sensing and broad-beam illumination with focused-beam sensing. Also included is a section describing scanner components and a scanner-characteristics section that reviews focal length, depth of field, color sensitivity, specular reflection, field of view, and beam shape. *Fixed Beam Scanners* is available for $5 a copy by sending a check to Literature Dept., AIM Inc., 1326 Freeport Rd., Pittsburgh, Pa. 15238. [Circle 426]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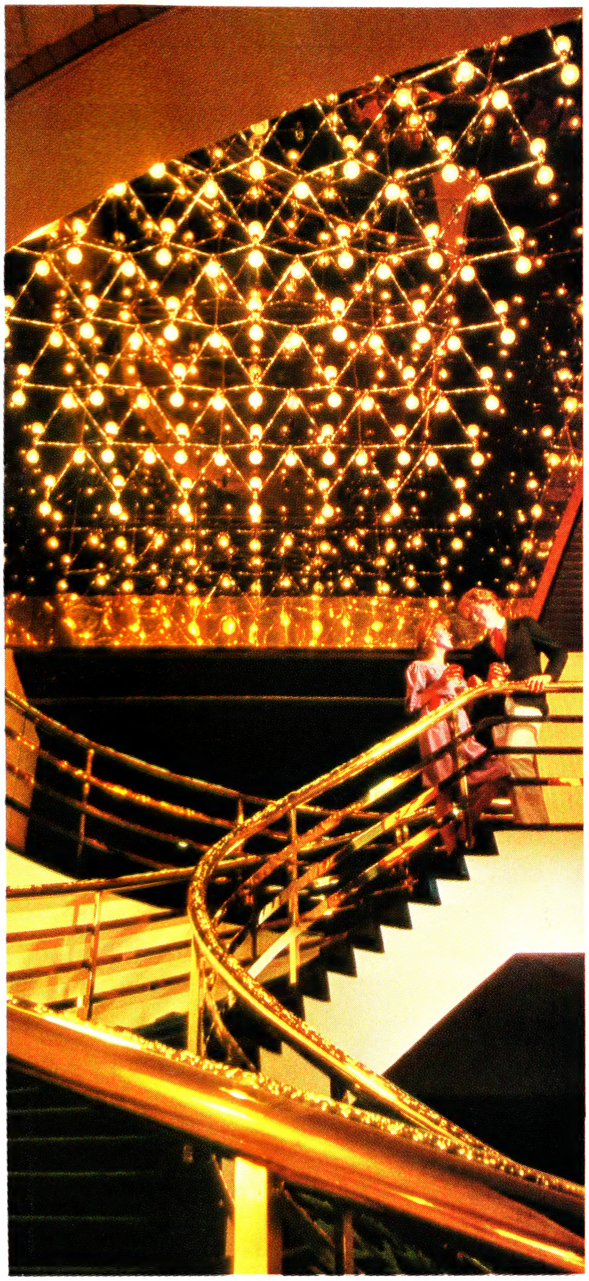

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SEMICONDUCTORS: DOWNTURN OR PAUSE?

Can the semiconductor industry avoid the cycles of boom and bust that have marked its history, confounded its strategic planners, and challenged even the most astute of its managers? Some observers believe it's possible that this industry—so crucial to the wealth and health of the electronics business—may soon be put to the test once again if some of the recent portents in the marketplace continue to indicate a downward trend.

Significant reductions in the book-to-bill ratio for semiconductors have been reported by the Semiconductor Industry Association in its most recent survey of U.S., European, and Japanese manufacturers. The survey found that the July 1984 book-to-bill ratio had slipped to 1.06, down from about 1.5 last January. Shipments are reported down 13% and orders found to have declined by nearly 9%—all while significant new capacity is coming on line for such major semiconductor suppliers as Intel, Motorola, and Advanced Micro Devices and while other companies are pumping out chips in three shifts, seven days a week.

But not to worry, says SIA president Thomas D. Hinkelman, who likens the situation to the one in 1979, when the U.S market grew 37% despite a similar July drop in orders. Pointing out that July is traditionally a slow month, Hinkelman anticipates that overall growth for the industry in 1984 will still hit the 40% mark the SIA projected earlier, better than 1979's. He fails to mention that in the following year the industry ran head-on into the recession, and for two years was plagued by overcapacity and declining demand.

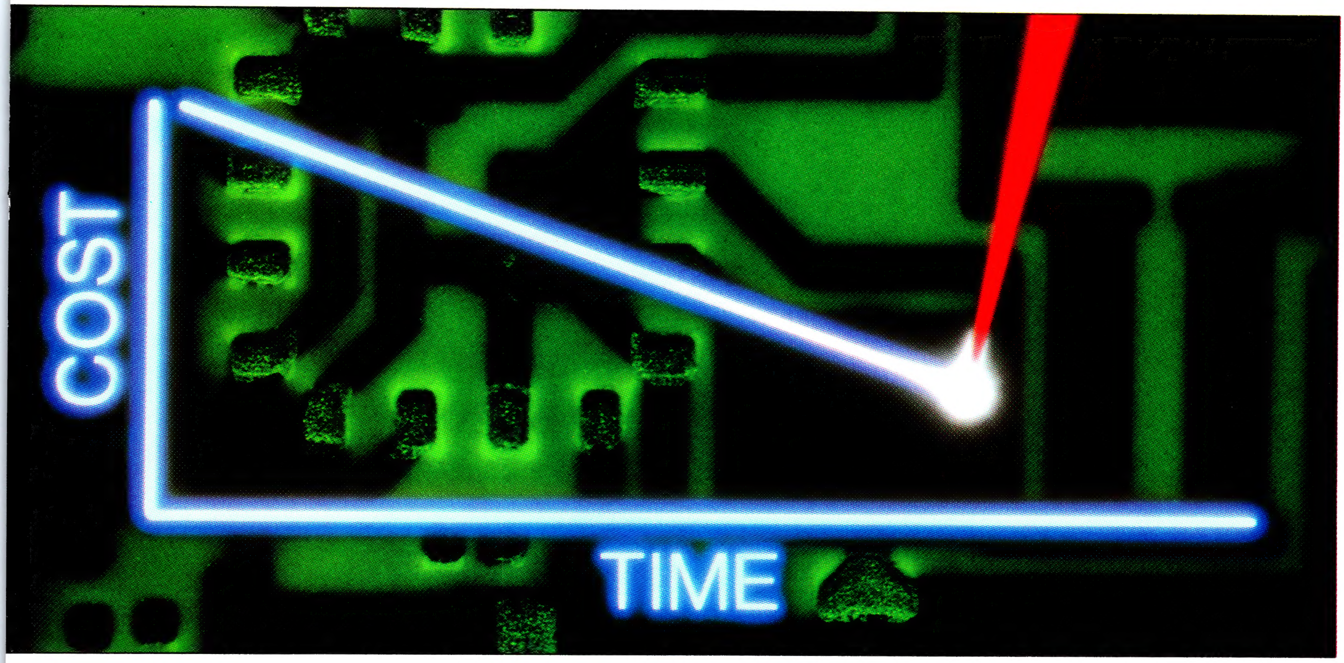
The semiconductor industry has always been characterized by great optimism and, to a large extent, this has accounted for its verve, drive, and remarkable growth. On the other hand, this trait has also sometimes resulted in an inability to foresee hard or changing times. Overcapacity coupled with declining demand hurt the industry in 1971 and 1974 and, as mentioned above, it was slow going for two years from 1980 to 1982. With all the acuity acquired by hindsight, we point out that even then the signs were available to anyone who cared to read them.

So that's why, despite Hinkelman's assurances, we worry a little when we see, for example, a consolidation taking place among personal computer manufacturers—who have accounted for a significant part of the semiconductor demand over the last three years—at a time when more and more of the remaining personal computer semiconductor demand can be satisfied by captive facilities.

Still, we should temper our call for caution with the observation that there are some good signs, too. The demand for advanced products such as high-performance microprocessors still exceeds supply. The automotive industry continues to be a voracious consumer of chips, and the rapidly growing telecommunications industry is providing a growing market for specialized chips.

If you add to this other significant changes in the industry structure—the accelerating growth of custom and semicustom integrated circuits, more mergers, and more willingness to cooperate on second-source agreements—one has to admit that the industry of today is strikingly different from that of only four years ago.

However, new markets opened up by technological innovations and changes in structure have failed in the past to arrest the boom-bust swings of the market pendulum. We hope that prudent management, mindful of recent experiences, will do the trick.



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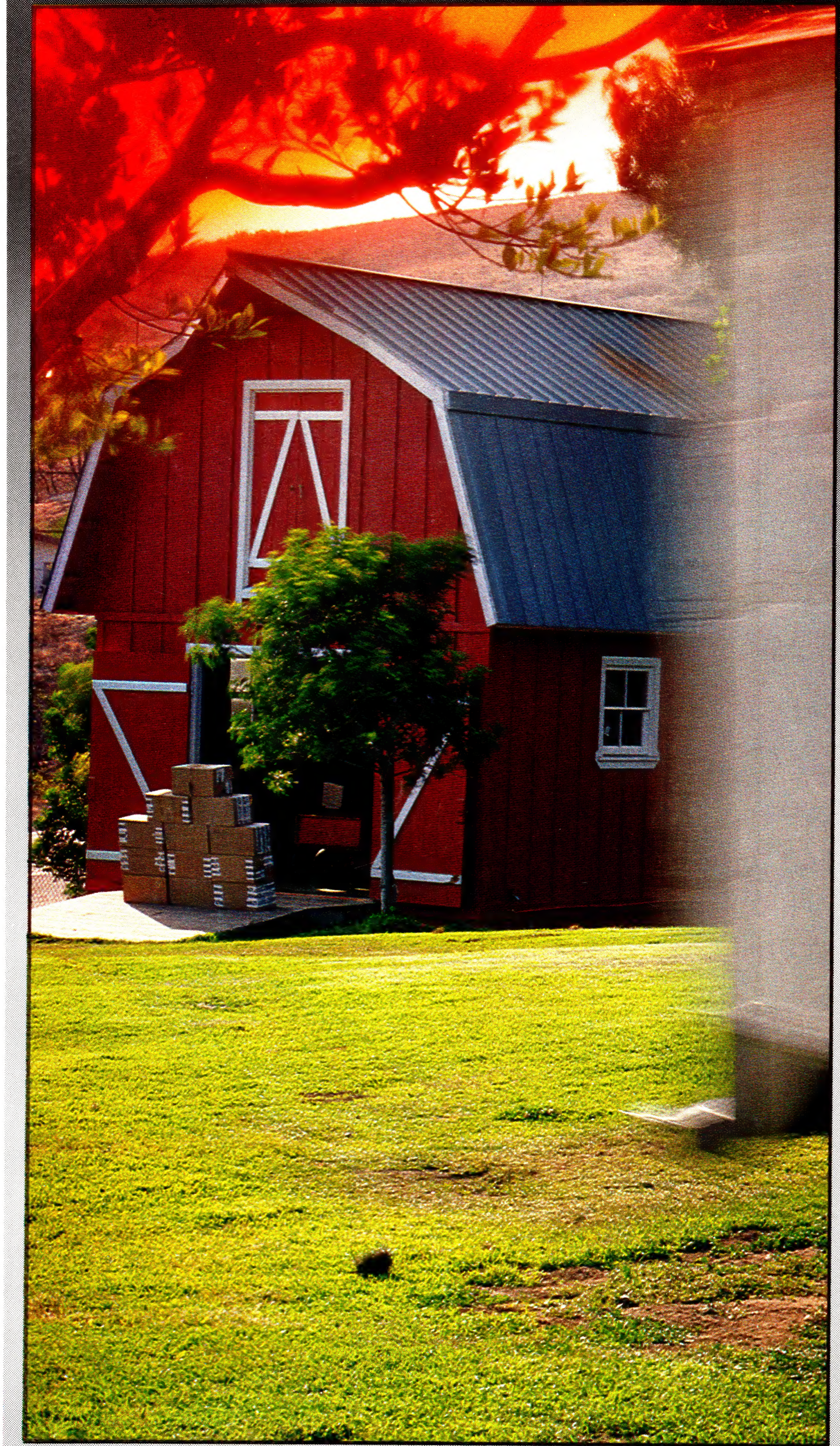

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